

2020 CFA[®]

PROGRAM EXAM PREP

SchweserNotes[™]

Level I

Corporate Finance, Equity Investments,
and Fixed Income

eBook 4

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LEARNING OUTCOME STATEMENTS (LOS)

STUDY SESSION 10

The topical coverage corresponds with the following CFA Institute assigned reading:

31. Introduction to Corporate Governance and Other ESG Considerations

The candidate should be able to:

- a. describe corporate governance. (page 1)
- b. describe a company's stakeholder groups and compare interests of stakeholder groups. (page 2)
- c. describe principal-agent and other relationships in corporate governance and the conflicts that may arise in these relationships. (page 3)
- d. describe stakeholder management. (page 4)
- e. describe mechanisms to manage stakeholder relationships and mitigate associated risks. (page 4)
- f. describe functions and responsibilities of a company's board of directors and its committees. (page 5)
- g. describe market and non-market factors that can affect stakeholder relationships and corporate governance. (page 8)
- h. identify potential risks of poor corporate governance and stakeholder management and identify benefits from effective corporate governance and stakeholder management. (page 10)
- i. describe factors relevant to the analysis of corporate governance and stakeholder management. (page 11)
- j. describe environmental and social considerations in investment analysis. (page 13)
- k. describe how environmental, social, and governance factors may be used in investment analysis. (page 13)

The topical coverage corresponds with the following CFA Institute assigned reading:

32. Capital Budgeting

The candidate should be able to:

- a. describe the capital budgeting process and distinguish among the various categories of capital projects. (page 21)
- b. describe the basic principles of capital budgeting. (page 23)
- c. explain how the evaluation and selection of capital projects is affected by mutually exclusive projects, project sequencing, and capital rationing. (page 24)
- d. calculate and interpret net present value (NPV), internal rate of return (IRR), payback period, discounted payback period, and profitability index (PI) of a single capital project. (page 25)
- e. explain the NPV profile, compare the NPV and IRR methods when evaluating independent and mutually exclusive projects, and describe the problems associated with each of the evaluation methods. (page 31)
- f. contrast the NPV decision rule to the IRR decision rule and identify problems associated with the IRR rule. (page 33)
- g. describe expected relations among an investment's NPV, company value, and share price. (page 35)

The topical coverage corresponds with the following CFA Institute assigned reading:

33. Cost of Capital

The candidate should be able to:

- a. calculate and interpret the weighted average cost of capital (WACC) of a company. (page 41)
- b. describe how taxes affect the cost of capital from different capital sources. (page 41)
- c. describe the use of target capital structure in estimating WACC and how target capital structure weights may be determined. (page 43)
- d. explain how the marginal cost of capital and the investment opportunity schedule are used to determine the optimal capital budget. (page 44)
- e. explain the marginal cost of capital's role in determining the net present value of a project. (page 45)
- f. calculate and interpret the cost of debt capital using the yield-to-maturity approach and the debt-rating approach. (page 45)
- g. calculate and interpret the cost of noncallable, nonconvertible preferred stock. (page 46)
- h. calculate and interpret the cost of equity capital using the capital asset pricing model approach, the dividend discount model approach, and the bond-yield-plus risk-premium approach. (page 47)
- i. calculate and interpret the beta and cost of capital for a project. (page 50)
- j. describe uses of country risk premiums in estimating the cost of equity. (page 52)
- k. describe the marginal cost of capital schedule, explain why it may be upward-sloping with respect to additional capital, and calculate and interpret its break-points. (page 53)
- l. explain and demonstrate the correct treatment of flotation costs. (page 55)

STUDY SESSION 11

The topical coverage corresponds with the following CFA Institute assigned reading:

34. Measures of Leverage

The candidate should be able to:

- a. define and explain leverage, business risk, sales risk, operating risk, and financial risk and classify a risk. (page 63)
- b. calculate and interpret the degree of operating leverage, the degree of financial leverage, and the degree of total leverage. (page 64)
- c. analyze the effect of financial leverage on a company's net income and return on equity. (page 67)
- d. calculate the breakeven quantity of sales and determine the company's net income at various sales levels. (page 68)
- e. calculate and interpret the operating breakeven quantity of sales. (page 68)

The topical coverage corresponds with the following CFA Institute assigned reading:

35. Working Capital Management

The candidate should be able to:

- a. describe primary and secondary sources of liquidity and factors that influence a company's liquidity position. (page 77)
- b. compare a company's liquidity measures with those of peer companies. (page 78)
- c. evaluate working capital effectiveness of a company based on its operating and cash conversion cycles and compare the company's effectiveness with that of peer companies. (page 80)
- d. describe how different types of cash flows affect a company's net daily cash position. (page 81)
- e. calculate and interpret comparable yields on various securities, compare portfolio returns against a standard benchmark, and evaluate a company's short-term investment policy guidelines. (page 81)
- f. evaluate a company's management of accounts receivable, inventory, and accounts payable over time and compared to peer companies. (page 83)
- g. evaluate the choices of short-term funding available to a company and recommend a financing method. (page 86)

STUDY SESSION 12

The topical coverage corresponds with the following CFA Institute assigned reading:

36. Market Organization and Structure

The candidate should be able to:

- a. explain the main functions of the financial system. (page 99)
- b. describe classifications of assets and markets. (page 101)
- c. describe the major types of securities, currencies, contracts, commodities, and real assets that trade in organized markets, including their distinguishing characteristics and major subtypes. (page 102)
- d. describe types of financial intermediaries and services that they provide. (page 105)
- e. compare positions an investor can take in an asset. (page 108)
- f. calculate and interpret the leverage ratio, the rate of return on a margin transaction, and the security price at which the investor would receive a margin call. (page 110)
- g. compare execution, validity, and clearing instructions. (page 112)
- h. compare market orders with limit orders. (page 112)
- i. define primary and secondary markets and explain how secondary markets support primary markets. (page 115)
- j. describe how securities, contracts, and currencies are traded in quote-driven, order-driven, and brokered markets. (page 117)
- k. describe characteristics of a well-functioning financial system. (page 119)
- l. describe objectives of market regulation. (page 120)

The topical coverage corresponds with the following CFA Institute assigned reading:

37. Security Market Indexes

The candidate should be able to:

- a. describe a security market index. (page 129)
- b. calculate and interpret the value, price return, and total return of an index. (page 129)
- c. describe the choices and issues in index construction and management. (page 130)
- d. compare the different weighting methods used in index construction. (page 130)
- e. calculate and analyze the value and return of an index given its weighting method. (page 133)
- f. describe rebalancing and reconstitution of an index. (page 137)
- g. describe uses of security market indexes. (page 137)
- h. describe types of equity indexes. (page 138)
- i. describe types of fixed-income indexes. (page 139)
- j. describe indexes representing alternative investments. (page 139)
- k. compare types of security market indexes. (page 141)

The topical coverage corresponds with the following CFA Institute assigned reading:

38. Market Efficiency

The candidate should be able to:

- a. describe market efficiency and related concepts, including their importance to investment practitioners. (page 149)
- b. distinguish between market value and intrinsic value. (page 150)
- c. explain factors that affect a market's efficiency. (page 150)
- d. contrast weak-form, semi-strong-form, and strong-form market efficiency. (page 151)
- e. explain the implications of each form of market efficiency for fundamental analysis, technical analysis, and the choice between active and passive portfolio management.

(page 152)

f. describe market anomalies. (page 153)

g. describe behavioral finance and its potential relevance to understanding market anomalies. (page 156)

STUDY SESSION 13

The topical coverage corresponds with the following CFA Institute assigned reading:

39. Overview of Equity Securities

The candidate should be able to:

- a. describe characteristics of types of equity securities. (page 163)
- b. describe differences in voting rights and other ownership characteristics among different equity classes. (page 165)
- c. distinguish between public and private equity securities. (page 165)
- d. describe methods for investing in non-domestic equity securities. (page 166)
- e. compare the risk and return characteristics of different types of equity securities. (page 168)
- f. explain the role of equity securities in the financing of a company's assets. (page 169)
- g. distinguish between the market value and book value of equity securities. (page 169)
- h. compare a company's cost of equity, its (accounting) return on equity, and investors' required rates of return. (page 170)

The topical coverage corresponds with the following CFA Institute assigned reading:

40. Introduction to Industry and Company Analysis

The candidate should be able to:

- a. explain uses of industry analysis and the relation of industry analysis to company analysis. (page 177)
- b. compare methods by which companies can be grouped, current industry classification systems, and classify a company, given a description of its activities and the classification system. (page 178)
- c. explain the factors that affect the sensitivity of a company to the business cycle and the uses and limitations of industry and company descriptors such as "growth," "defensive," and "cyclical." (page 181)
- d. explain how a company's industry classification can be used to identify a potential "peer group" for equity valuation. (page 182)
- e. describe the elements that need to be covered in a thorough industry analysis. (page 182)
- f. describe the principles of strategic analysis of an industry. (page 183)
- g. explain the effects of barriers to entry, industry concentration, industry capacity, and market share stability on pricing power and price competition. (page 185)
- h. describe industry life cycle models, classify an industry as to life cycle stage, and describe limitations of the life-cycle concept in forecasting industry performance. (page 187)
- i. compare characteristics of representative industries from the various economic sectors. (page 189)
- j. describe macroeconomic, technological, demographic, governmental, and social influences on industry growth, profitability, and risk. (page 190)
- k. describe the elements that should be covered in a thorough company analysis. (page 191)

The topical coverage corresponds with the following CFA Institute assigned reading:

41. Equity Valuation: Concepts and Basic Tools

The candidate should be able to:

- a. evaluate whether a security, given its current market price and a value estimate, is overvalued, fairly valued, or undervalued by the market. (page 201)
- b. describe major categories of equity valuation models. (page 202)
- c. describe regular cash dividends, extra dividends, stock dividends, stock splits, reverse stock splits, and share repurchases. (page 203)
- d. describe dividend payment chronology. (page 204)
- e. explain the rationale for using present value models to value equity and describe the dividend discount and free-cash-flow-to-equity models. (page 205)
- f. calculate the intrinsic value of a non-callable, non-convertible preferred stock. (page 208)
- g. calculate and interpret the intrinsic value of an equity security based on the Gordon (constant) growth dividend discount model or a two-stage dividend discount model, as appropriate. (page 208)
- h. identify characteristics of companies for which the constant growth or a multistage dividend discount model is appropriate. (page 213)
- i. explain the rationale for using price multiples to value equity, how the price to earnings multiple relates to fundamentals, and the use of multiples based on comparables. (page 214)
- j. calculate and interpret the following multiples: price to earnings, price to an estimate of operating cash flow, price to sales, and price to book value. (page 215)
- k. describe enterprise value multiples and their use in estimating equity value. (page 219)
- l. describe asset-based valuation models and their use in estimating equity value. (page 220)
- m. explain advantages and disadvantages of each category of valuation model. (page 222)

STUDY SESSION 14

The topical coverage corresponds with the following CFA Institute assigned reading:

42. Fixed-Income Securities: Defining Elements

The candidate should be able to:

- a. describe basic features of a fixed-income security. (page 238)
- b. describe content of a bond indenture. (page 239)
- c. compare affirmative and negative covenants and identify examples of each. (page 239)
- d. describe how legal, regulatory, and tax considerations affect the issuance and trading of fixed-income securities. (page 240)
- e. describe how cash flows of fixed-income securities are structured. (page 244)
- f. describe contingency provisions affecting the timing and/or nature of cash flows of fixed-income securities and identify whether such provisions benefit the borrower or the lender. (page 248)

The topical coverage corresponds with the following CFA Institute assigned reading:

43. Fixed-Income Markets: Issuance, Trading, and Funding

The candidate should be able to:

- a. describe classifications of global fixed-income markets. (page 255)
- b. describe the use of interbank offered rates as reference rates in floating-rate debt. (page 256)
- c. describe mechanisms available for issuing bonds in primary markets. (page 257)
- d. describe secondary markets for bonds. (page 258)
- e. describe securities issued by sovereign governments. (page 258)
- f. describe securities issued by non-sovereign governments, quasi-government entities, and supranational agencies. (page 259)
- g. describe types of debt issued by corporations. (page 260)
- h. describe structured financial instruments. (page 262)
- i. describe short-term funding alternatives available to banks. (page 264)
- j. describe repurchase agreements (repos) and the risks associated with them. (page 265)

The topical coverage corresponds with the following CFA Institute assigned reading:

44. Introduction to Fixed-Income Valuation

The candidate should be able to:

- a. calculate a bond's price given a market discount rate. (page 271)
- b. identify the relationships among a bond's price, coupon rate, maturity, and market discount rate (yield-to-maturity). (page 273)
- c. define spot rates and calculate the price of a bond using spot rates. (page 276)
- d. describe and calculate the flat price, accrued interest, and the full price of a bond. (page 277)
- e. describe matrix pricing. (page 278)
- f. calculate annual yield on a bond for varying compounding periods in a year. (page 280)
- g. calculate and interpret yield measures for fixed-rate bonds and floating-rate notes. (page 280)
- h. calculate and interpret yield measures for money market instruments. (page 286)
- i. define and compare the spot curve, yield curve on coupon bonds, par curve, and forward curve. (page 288)
- j. define forward rates and calculate spot rates from forward rates, forward rates from spot rates, and the price of a bond using forward rates. (page 290)

- k. compare, calculate, and interpret yield spread measures. (page 294)

The topical coverage corresponds with the following CFA Institute assigned reading:

45. Introduction to Asset-Backed Securities

The candidate should be able to:

- a. explain benefits of securitization for economies and financial markets. (page 303)
- b. describe securitization, including the parties involved in the process and the roles they play. (page 304)
- c. describe typical structures of securitizations, including credit tranching and time tranching. (page 306)
- d. describe types and characteristics of residential mortgage loans that are typically securitized. (page 307)
- e. describe types and characteristics of residential mortgage-backed securities, including mortgage pass-through securities and collateralized mortgage obligations, and explain the cash flows and risks for each type. (page 309)
- f. define prepayment risk and describe the prepayment risk of mortgage-backed securities. (page 309)
- g. describe characteristics and risks of commercial mortgage-backed securities. (page 315)
- h. describe types and characteristics of non-mortgage asset-backed securities, including the cash flows and risks of each type. (page 317)
- i. describe collateralized debt obligations, including their cash flows and risks. (page 319)

STUDY SESSION 15

The topical coverage corresponds with the following CFA Institute assigned reading:

46. Understanding Fixed-Income Risk and Return

The candidate should be able to:

- a. calculate and interpret the sources of return from investing in a fixed-rate bond. (page 327)
- b. define, calculate, and interpret Macaulay, modified, and effective durations. (page 333)
- c. explain why effective duration is the most appropriate measure of interest rate risk for bonds with embedded options. (page 336)
- d. define key rate duration and describe the use of key rate durations in measuring the sensitivity of bonds to changes in the shape of the benchmark yield curve. (page 338)
- e. explain how a bond's maturity, coupon, and yield level affect its interest rate risk. (page 338)
- f. calculate the duration of a portfolio and explain the limitations of portfolio duration. (page 339)
- g. calculate and interpret the money duration of a bond and price value of a basis point (PVBP). (page 340)
- h. calculate and interpret approximate convexity and distinguish between approximate and effective convexity. (page 342)
- i. Estimate the percentage price change of a bond for a specified change in yield, given the bond's approximate duration and convexity. (page 344)
- j. describe how the term structure of yield volatility affects the interest rate risk of a bond. (page 345)
- k. describe the relationships among a bond's holding period return, its duration, and the investment horizon. (page 345)
- l. explain how changes in credit spread and liquidity affect yield-to-maturity of a bond and how duration and convexity can be used to estimate the price effect of the changes. (page 347)

The topical coverage corresponds with the following CFA Institute assigned reading:

47. Fundamentals of Credit Analysis

The candidate should be able to:

- a. describe credit risk and credit-related risks affecting corporate bonds. (page 355)
- b. describe default probability and loss severity as components of credit risk. (page 355)
- c. describe seniority rankings of corporate debt and explain the potential violation of the priority of claims in a bankruptcy proceeding. (page 356)
- d. distinguish between corporate issuer credit ratings and issue credit ratings and describe the rating agency practice of "notching." (page 357)
- e. explain risks in relying on ratings from credit rating agencies. (page 359)
- f. explain the four Cs (Capacity, Collateral, Covenants, and Character) of traditional credit analysis. (page 359)
- g. calculate and interpret financial ratios used in credit analysis. (page 363)
- h. evaluate the credit quality of a corporate bond issuer and a bond of that issuer, given key financial ratios of the issuer and the industry. (page 363)
- i. describe factors that influence the level and volatility of yield spreads. (page 365)
- j. explain special considerations when evaluating the credit of high yield, sovereign, and non-sovereign government debt issuers and issues. (page 366)

The following is a review of the Corporate Finance (1) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #31.

READING 31: INTRODUCTION TO CORPORATE GOVERNANCE AND OTHER ESG CONSIDERATIONS

Study Session 10

EXAM FOCUS

Candidates should understand the idea of a firm's stakeholders, how conflicts can arise between stakeholders, and how effective corporate governance can mitigate problems arising from these conflicts. Other important points are the election of the board of directors, the board's duties, and important factors in board composition. Finally, the rationale for incorporating environmental, social, and governance factors into the portfolio selection process is presented.

MODULE 31.1: STAKEHOLDER MANAGEMENT



LOS 31.a: Describe corporate governance.

Video covering this content is available online.

CFA[®] Program Curriculum, Volume 4, page 6

In the CFA Institute publication, *The Corporate Governance of Listed Companies: A Manual for Investors*¹, corporate governance is described as “the system of internal controls and procedures by which individual companies are managed. It provides a framework that defines the rights, roles and responsibilities of various groups . . . within an organization. At its core, corporate governance is the arrangement of checks, balances, and incentives a company needs in order to minimize and manage the conflicting interests between insiders and external shareowners.”

Under **shareholder theory**, the primary focus of a system of corporate governance is the interests of the firm's shareholders, which are taken to be the maximization of the market value of the firm's common equity. Under this theory, corporate governance is primarily concerned with the conflict of interest between the firm's managers and its owners (shareholders).

The focus of corporate governance under **stakeholder theory** is broader; it considers conflicts among the several groups that have an interest in the activities and performance of the firm. These groups include shareholders, employees, suppliers, and customers, among others.

LOS 31.b: Describe a company's stakeholder groups and compare interests of stakeholder groups.

CFA[®] Program Curriculum, Volume 4, page 8

The following have been identified as the primary stakeholders of a corporation.

Shareholders have a residual interest in the corporation in that they have claim to the net assets of the corporation after all liabilities have been settled. Shareholders have voting rights for the election of the board of directors and for other important corporate matters, which gives them effective control of the firm and its management. They have an interest in the ongoing profitability and growth of the firm, both of which can increase the value of their ownership shares.

The **board of directors** has a responsibility to protect the interests of shareholders; to hire, fire, and set the compensation of the firm's senior managers; to set the strategic direction of the firm; and to monitor financial performance and other aspects of the firm's ongoing activities.

Typically, the firm's executives (most-senior managers) serve on the board of directors, along with directors who are not otherwise employed by the firm. In a one-tier board structure, both company executives and non-executive board members serve on a single board of directors. In some countries, boards have a two-tier structure in which the non-executive board members serve on a supervisory board that oversees a management board, made up of company executives.

Senior managers typically receive compensation (remuneration) that is made up of a salary, a bonus based on some measure of company performance, and perquisites (e.g., expense accounts, use of company planes, special retirement benefits, vacation time off). Their interests can be expected to include continued employment and maximizing the total value of their compensation. Executive bonuses are typically tied to some measure of firm performance, giving senior managers a strong interest in the financial success of the firm.

Employees also have an interest in the sustainability and success of the firm. They have an interest in their rate of pay, opportunities for career advancement, training, and working conditions.

Creditors supply debt capital to the firm and are primarily owners of the firm's outstanding bonds and banks that have made loans to the firm. Providers of debt capital to the firm do not typically have a vote in firm management and do not participate in firm growth beyond receiving their promised interest and principal payments. The interests of creditors are protected to varying degrees by covenants in their debt agreements with the firm.

Suppliers of resources to the firm have an interest preserving an ongoing relationship with the firm, in the profitability of their trade with the firm, and in the growth and ongoing stability of the firm. As they are typically short-term creditors of the firm, they also have an interest in the firm's solvency and ongoing financial strength.

LOS 31.c: Describe principal–agent and other relationships in corporate governance and the conflicts that may arise in these relationships.

CFA® Program Curriculum, Volume 4, page 11

The **principal-agent conflict** arises because an agent is hired to act in the interest of the principal, but an agent's interests may not coincide exactly with those of the principal. Consider an insurance agent who is paid a commission on policies written. It would be in the agent's interest to write insurance policies on people or property that are not good risks, in order to maximize commission income. The principal (the owners of the insurance company)

does not want to issue policies that are bad risks as that is a money-losing proposition. Insurance companies mitigate this conflict by imposing underwriting standards for the policies they will issue and by continuing to work only with agents who consistently act in the company's best interest.

Conflicts of interest between shareholders and managers or directors

In the context of a corporation, shareholders are the principals (owners), and firm management and board members (directors) are their agents. Managers and directors may choose a lower level of business risk than shareholders would. This conflict can arise because the risk of company managers and directors is more dependent of firm performance compared to the risk of shareholders, who hold diversified portfolios of stocks and are not dependent on the firm for employment.

Conflicts may also arise when directors who are also managers favor management interests at the expense of shareholders or when directors favor one group of shareholders at the expense of another.

There is also an **information asymmetry** between shareholders and managers because managers have more and better information about the functioning of the firm and its strategic direction than shareholders do. This decreases the ability of shareholders or non-executive directors to monitor and evaluate whether managers are acting in the best interests of shareholders.

Conflicts between groups of shareholders

A single shareholder or group of shareholders may hold a majority of the votes and act against the interests of the minority shareholders. Some firms have different classes of common stock outstanding, some with more voting power than others. A group of shareholders may have effective control of the company although they have a claim to less than 50% of the earnings and assets of the company.

In the event of an acquisition of the company, controlling shareholders may be in a position to get better terms for themselves relative to the terms forced on minority shareholders. Majority shareholders may cause the company to enter into **related party transactions**, agreements or specific transactions that benefit entities in which they have a financial interest, to the detriment of minority shareholders.

Conflicts of interest between creditors and shareholders

Shareholders may prefer more business risk than creditors do because creditors have a limited upside from good results compared to shareholders. Equity owners could also act against the interests of creditors by issuing new debt that increases the default risk faced by existing debt holders, or by the company paying greater dividends to equity holders, thereby increasing creditors' risk of default.

Conflicts of interest between shareholders and other stakeholders

The company may decide to raise prices or reduce product quality in order to increase profits to the detriment of customers. The company may employ strategies that significantly reduce the taxes they pay to the government.

LOS 31.d: Describe stakeholder management.

LOS 31.e: Describe mechanisms to manage stakeholder relationships and mitigate associated risks.

CFA® Program Curriculum, Volume 4, page 14

Stakeholder management refers to the management of company relations with stakeholders and is based on having a good understanding of stakeholder interests and maintaining effective communication with stakeholders. The management of stakeholder relationships is based on four types of infrastructures:

1. The **legal infrastructure** identifies the laws relevant to and the legal recourse of stakeholders when their rights are violated.
2. The **contractual infrastructure** refers to the contracts between the company and its stakeholders that spell out the rights and responsibilities of the company and the stakeholders.
3. The **organizational infrastructure** refers to a company's corporate governance procedures, including its internal systems and practices that address how it manages its stakeholder relationships.
4. **Governmental infrastructure** comprises the regulations to which companies are subject.

With respect to the company's relationship with shareholders, there are standard practices. These practices are required by corporate laws and similar in many jurisdictions, although there are some differences across countries.

Corporations typically hold an **annual general meeting** after the end of the firm's fiscal year. At the general meeting, company management provides shareholders with the audited financial statements for the year, addresses the company's performance and significant actions over the period, and answers shareholder questions.

Corporate laws dictate when the annual general meeting may occur and how the meeting must be communicated to shareholders. Typically, anyone owning shares is permitted to attend the annual general meeting, to speak or ask questions, and to vote their shares. A shareholder who does not attend the annual general meeting can vote her shares by **proxy**, meaning she assigns her right to vote to another who will attend the meeting, often a director, member of management, or the shareholder's investment advisor. A proxy may specify the shareholder's vote on specific issues or leave the vote to the discretion of the person to whom the proxy is assigned.

Ordinary resolutions, such as approval of auditor and the election of directors, require a simple majority of the votes cast. Other resolutions, such as those regarding a merger or takeover, or that require amendment of corporate bylaws, are termed **special resolutions** and may require a supermajority vote for passage, typically two-thirds or three-fourths of the votes cast. Such special resolutions can also be addressed at **extraordinary general**

meetings, which can be called anytime there is a resolution about a matter that requires a vote of the shareholders.

When there are multiple board member elections at one meeting, some companies use majority voting and some use cumulative voting. With **majority voting**, the candidate with the most votes for each single board position is elected. With **cumulative voting**, shareholders can cast all their votes (shares times number of board position elections) for a single board candidate or divide them among board candidates. Cumulative voting can result in greater minority shareholder representation on the board compared to majority voting.

Minority shareholders may have special rights by law when the company is acquired by another company.

LOS 31.f: Describe functions and responsibilities of a company's board of directors and its committees.

CFA® Program Curriculum, Volume 4, page 21

Board structure

A company may have any number of directors on its board. Companies often have directors with expertise in specific areas of the firm's business, such as risk management, finance, or industry strategy. In a **one-tier board**, there is a single board of directors that includes both internal and external directors. Internal directors (also called executive directors) are typically senior managers employed by the firm. External board members (also called non-executive directors) are those who are not company management. Non-executive directors who have no other relationship with the company are termed **independent directors**. Employee board representatives may be a significant portion of the non-executive directors.

In a **two-tier board** structure, there is a supervisory board that typically excludes executive directors. The supervisory board and the management board (made up of executive directors) operate independently. The management board is typically led by the company's CEO.

With a one-tier board, the chairman of the board is sometimes the company CEO. While this was common practice in the United States historically, separation of the CEO and chairman of the board functions has become more common in recent years. When a **lead independent director** is appointed, he has the ability to call meetings of the independent directors, separate from meetings of the full board.

Currently, the general practice is for all board member elections to be held at the same meeting and each election to be for multiple years. With a **staggered board**, elections for some board positions are held each year. This structure limits the ability of shareholders to replace board members in any one year and is used less now than it has been historically.

Board responsibilities

The board of directors is elected by shareholders to act in their interest. Board members are typically mandated by corporate law to be fully informed and to use due diligence and their expertise in fulfilling their obligation to act in the interests of the company and its shareholders.

The board of directors is not involved in the day-to-day management of the company; that responsibility rests with senior management. The duties of the board include responsibility

for:

- Selecting senior management, setting their compensation and bonus structure, evaluating their performance, and replacing them as needed.
- Setting the strategic direction for the company and making sure that management implements the strategy approved by the board.
- Approving capital structure changes, significant acquisitions, and large investment expenditures.
- Reviewing company performance and implementing any necessary corrective steps.
- Planning for continuity of management and the succession of the CEO and other senior managers.
- Establishing, monitoring, and overseeing the firm's internal controls and risk management system.
- Ensuring the quality of the firm's financial reporting and internal audit, as well as oversight of the external auditors.

Board committees

A board of directors typically has committees made up of board members with particular expertise. These committees report to the board, which retains the overall responsibility for the various board functions. The following are examples of typical board committees.

An **audit committee** is responsible for:

- Oversight of the financial reporting function and implementation of accounting policies.
- Effectiveness of the company's internal controls and the internal audit function.
- Recommending an external auditor and its compensation.
- Proposing remedies based on their review of internal and external audits.

A **governance committee** is responsible for:

- Oversight of the company's corporate governance code.
- Implementing the company's code of ethics and policies regarding conflicts of interest.
- Monitoring changes in relevant laws and regulations.
- Ensuring that the company is in compliance with all applicable laws and regulations, as well as with the company's governance policies.

A **nominations committee** proposes qualified candidates for election to the board, manages the search process, and attempts to align the board's composition with the company's corporate governance policies.

A **compensation committee** or **remuneration committee** recommends to the board the amounts and types of compensation to be paid to directors and senior managers. This committee may also be responsible for oversight of employee benefit plans and evaluation of senior managers.

A **risk committee** informs the board about appropriate risk policy and risk tolerance of the organization, and oversees the enterprise-wide risk management processes of the organization.

An **investment committee** reviews and reports to the board on management proposals for large acquisitions or projects, sale or other disposal of company assets or segments, and the performance of acquired assets and other large capital expenditures.

The number and size of board committees will depend on the size, complexity, and nature of the business. Regulations often require that firms have audit committees. Financial services firms are often required to have a risk committee as well. Some companies combine two functions into one committee. The composition of a board committee is often based on its function, with audit committees, compensation committees, and governance committees often made up of only non-executive or independent directors.



MODULE QUIZ 31.1

To best evaluate your performance, enter your quiz answers online.

1. The theory that deals with conflicts of interest between a company's owners and its creditors is *most appropriately* called:
 - A. structure theory.
 - B. stakeholder theory.
 - C. shareholder theory.
2. For which two of a company's stakeholders does information asymmetry *most likely* make monitoring more difficult?
 - A. Suppliers and employees.
 - B. Employees and managers.
 - C. Managers and shareholders.
3. The *least likely* item to be a requirement for good stakeholder management is:
 - A. maintaining effective communication with other stakeholders.
 - B. an understanding of the interests of several stakeholder groups.
 - C. the ability to put aside the interests of one's stakeholder group.
4. An agreement between a company and a labor union that represents most of its employees would be *most appropriately* considered part of a company's:
 - A. legal infrastructure.
 - B. contractual infrastructure.
 - C. organizational infrastructure.
5. The type of voting that is *most likely* to allow minority stockholders a greater representation on the board of directors is:
 - A. majority voting.
 - B. staggered voting.
 - C. cumulative voting.
6. The type of resolution *most likely* to require a supermajority of shareholder votes for passage is a resolution to:
 - A. acquire a company.
 - B. choose a board member.
 - C. approve the choice of an auditor.
7. The board of directors committee *most likely* to be responsible for monitoring the performance of a project that requires a large capital expenditure is:
 - A. the risk committee.
 - B. the audit committee.
 - C. the investment committee.

MODULE 31.2: FACTORS AFFECTING CORPORATE GOVERNANCE

LOS 31.g: Describe market and non-market factors that can affect stakeholder relationships and corporate governance.



Video covering this content is available online.

Several capital market factors can affect corporate governance and stakeholder relationships. Companies that work to have more communication and contact with shareholders, in addition to annual meetings and analyst meetings, have improved relations with shareholders who may be more likely to support management proposals and positions in the event of negative comments or pressure for change from dissident shareholder groups.

Activist shareholders pressure companies in which they hold a significant number of shares for changes, often changes they believe will increase shareholder value. They may bring pressure for change by initiating shareholder lawsuits or by seeking representation on the board of directors. Other activist tactics include proposing shareholder resolutions for a vote and raising their issues to all shareholders or the public to gain wider support. Hedge funds have, more and more, engaged in shareholder activism to increase the market values of firms in which they hold significant stakes.

A group may initiate a **proxy fight**, in which they seek the proxies of shareholders to vote in favor of their alternative proposals and policies. An activist group may make a **tender offer** for a specific number of shares of a company to gain enough votes to take over the company.

Both senior managers and boards of directors can be replaced by shareholders if they believe company performance is poor and would be improved by a change. The threat of a **hostile takeover**, one not supported by the company's management, can act as an incentive to influence company managements and boards to pursue policies more in alignment with the interests of shareholders and oriented toward increasing shareholder value.

Issues of corporate governance and conflicts of interest arise when company management proposes and the board passes anti-takeover measures to protect their jobs. Staggered board elections make a hostile takeover more costly and difficult.

An important non-market factor that can affect stakeholder relationships is the legal environment within which the company operates. Shareholders' and creditors' interests are considered to be better protected in countries with a **common-law system** under which judges' rulings become law in some instances. In a **civil law system**, judges are bound to rule based only on specifically enacted laws. In general, the rights of creditors are more clearly defined than those of shareholders and, therefore, are not as difficult to enforce through the courts.

In the past, corporate boards and managements have had an advantage in communicating through the media to influence shareholders or to shape public opinion. Advances in communications, especially through internet outlets and social media sites, have levelled the playing fields to a significant degree. It has become much easier for dissident shareholders to bring issues to the attention of other shareholders and to influence public opinion about certain issues. Among senior managers and board members, concern about their professional reputations has increased as a result. Media exposure can act as an important incentive for management to pursue policies that are consistent with the interests of shareholders and avoid egregious related-party transactions.

In 2003, the U.S. SEC mandated that U.S.-registered mutual funds institute policies and procedures to ensure that the proxies they hold for investors in their funds are voted in the best interests of fund investors. Prior to this, many funds that held shares for investors failed

to devote resources to fulfill their responsibility to vote proxies. U.S. funds are also required to disclose their proxy voting records.

Overall, the increased focus on the importance of good corporate governance has given rise to a new industry focused on corporate governance, which includes firms that advise funds on proxy voting and corporate governance matters. Firms that provide ratings of companies' corporate governance practices offer another avenue to influence managements to better address the interests of shareholders.

LOS 31.h: Identify potential risks of poor corporate governance and stakeholder management and identify benefits from effective corporate governance and stakeholder management.

CFA® Program Curriculum, Volume 4, page 28

Risks of poor governance and stakeholder management

When corporate governance is weak, the control functions of audits and board oversight may be weak as well. The risk is that some stakeholders can gain an advantage, to the disadvantage of other stakeholders. Accounting fraud, or simply poor recordkeeping, will have negative implications for company performance and value.

When governance is weak and managers are not monitored, they may choose lower-than-optimal risk, reducing company value. Without proper monitoring and oversight, management may have incentive compensation that causes them to pursue their own benefit rather than the company's benefit. If they are allowed to engage in related-party transactions that benefit their friends or family, this will decrease company value.

Poor compliance procedures with respect to regulation and reporting can easily lead to legal and reputational risks. Violating stakeholder rights can lead to stakeholder lawsuits. A company's reputation can be damaged by failure to comply with governmental regulations. Failure to manage creditors' rights can lead to debt default and bankruptcy.

Benefits of effective governance and stakeholder management

Effective corporate governance can improve operational efficiency by ensuring that management and board member incentives align their interests well with those of shareholders. Effective governance implies effective control and monitoring. Just as weak control can lead to abuses, a strong system of controls and compliance with laws and regulations can avoid many legal and regulatory risks.

Formal policies regarding conflicts of interest and related party transactions can also lead to better operating results. Proper governance with respect to the interests of creditors can reduce the risk of debt default or bankruptcy, thereby reducing the cost of debt financing. Alignment of management interests with those of shareholders leads to better financial performance and greater company value.

LOS 31.i: Describe factors relevant to the analysis of corporate governance and stakeholder management.

CFA® Program Curriculum, Volume 4, page 31

In recent years, both analysts and markets have had an increased focus on effective corporate governance as an important factor in operational and financial performance. Elements of corporate governance that analysts have focused on include ownership and voting structures, board composition, management remuneration, the composition of shareholders, strength of shareholder rights, and management of long-term risks.

Company ownership and voting structure

Voting control of companies is typically proportional to share ownership because each share entitles its holder to one vote. In a **dual class structure**, one class of shares may be entitled to several votes per share, while another class of shares is entitled to one vote per share. This structure is often used to ensure that founding shareholders (and, later, their heirs) can maintain control of the board of directors even when their economic ownership is significantly less than 50%. Companies with a dual-class share structure have traded, on average, at a discount to comparable companies with a single class of shares.

Clearly, the interests of the owners of shares with multiple votes will take precedence over the interests of shareholders in general. Analysts will consider what the interests of the controlling shareholders are and how the ownership of the controlling shares is expected to change over time.

Composition of a company's board

Analysts may want to consider carefully the make-up of a company's board of directors. Important considerations are whether directors:

- Are executive, non-executive, or independent directors.
- Are involved in related-party transactions with the company.
- Have the diversity of expertise that suits the company's current strategy and challenges.
- Have served for many years and may have become too close to the company's management.

Overall, an analyst must decide if the board is responsive to shareholder interests or has conflicts of interest, and if the board has the mix of expertise that is needed to deal with challenges and pursue the best strategy for the company.

Management incentives and remuneration

In addition to salary, senior corporate managers often receive cash bonuses based on short-term performance metrics and bonuses based on longer-term equity performance, such as company shares or options to be awarded at future dates. While such plans are typically described as being a mechanism to align the interests of management and shareholders more closely, in many cases they may not do that well. Analysts may be concerned if:

- The remuneration plan seems to offer greater incentives, paid in cash, to achieve short-term performance goals at the expense of building long-term company value through equity-based incentives.
- Performance-based incentive pay is fairly stable over time, indicating that the performance targets are possibly easy to achieve.
- Management remuneration is very high relative to that of comparable companies in the industry.

- Management incentives are not aligned with current company strategy and objectives.

Composition of shareholders

If a significant portion of a company's outstanding shares are held by an affiliated company or institution, those shareholders may be able to exert enough influence to dictate the company's policies and direction. In some countries, it is quite common for one company to hold a large minority stake in another company. Some claim that such cross-holdings between companies lead to greater stability, better cooperation between the two companies, and a longer-term perspective on company performance. However, when the shareholder company tends to vote with management and to support board members with long tenure, it can hinder change by protecting the company from potential hostile takeovers and activist shareholders.

Activist shareholders and investors who buy shares in an attempt to profit from their activism can cause changes in the composition of a firm's shareholders, its board membership, and its corporate strategy in a relatively short period of time.

Relative strength of shareholders' rights

If the rights of shareholders are weak, perceived increases in shareholder returns from being acquired or from significant changes in corporate strategy may be difficult or impossible to realize. Examples of weak shareholders' rights are the existence of anti-takeover provisions in the corporate charter or bylaws, staggered boards, and a class of super voting shares, which all restrict the rights of shareholders to effect change.

Management of long-term risks

Analysts should be concerned if a company does not manage the risks of stakeholder conflicts well over time. A failure to manage stakeholder issues well or a failure to manage other long-term risks to the company's sustainability can have disastrous consequences for shareholders and others with interests tied to company results.

LOS 31.j: Describe environmental and social considerations in investment analysis.

CFA® Program Curriculum, Volume 4, page 36

While the quality of corporate governance has long been a consideration in investment analysis, the consideration of environmental and social factors is a more recent development. The use of environmental, social, and governance factors in making investment decisions is referred to as **ESG investing**. Many issues can be considered in this context, including harm or potential harm to the environment, risk of loss due to environmental accidents, the changing demographics of the workforce, and reputational risks from corrupt practices or human rights abuses.

ESG investing is also termed **sustainable investing** or **responsible investing** and sometimes **socially responsible investing**, although that term can be somewhat ambiguous because it previously referred to investing that integrated ethical or moral concerns into the portfolio selection process.

Conflict may occur when integrating ESG considerations into portfolio construction when the manager has a fiduciary responsibility to act in the best financial interests of the account

owner or beneficiaries. Choosing to construct a portfolio based on an environmental, social, or governance concern at the expense of investor returns would violate the manager's fiduciary duty. In the United States, the Employee Retirement Income Security Act (ERISA) describes the fiduciary duty of pension fund managers. Recently, the U.S. Department of Labor addressed this potential conflict, stating that using ESG factors in determining the risk and expected return of securities is not a violation of the manager's fiduciary responsibilities. Additionally, it was determined that for two investments that have the same relevant financial characteristics, using ESG factors to choose one over the other is not a violation of the fiduciary duty imposed by ERISA.

LOS 31.k: Describe how environmental, social, and governance factors may be used in investment analysis.

CFA® Program Curriculum, Volume 4, page 40

There are several approaches to integrating ESG factors into the portfolio management process. The following are some important examples.

Negative screening refers to excluding specific companies or industries from consideration for the portfolio based on their practices regarding human rights, environmental concerns, or corruption. Examples of industries where ESG factors might lead to exclusion are mining, oil extraction and transport, and tobacco. Specific companies that might be excluded are those with poor records on corruption and human rights (labor) practices. Company scores based on a range of ESG concerns are often used in negative screening to identify companies that should be excluded.

Under the **positive screening** approach, investors attempt to identify companies that have positive ESG practices. For example, a portfolio manager may focus on environmental sustainability, employee rights and safety, and overall governance practices. Often a scoring system across a set of ESG factors is used to identify companies for inclusion in portfolios. A related approach, the **relative/best-in-class** approach, seeks to identify companies within each industry group with the best ESG practices. By constructing portfolios of these companies, a manager can preserve the index sector weightings in the portfolio while still taking advantage of opportunities to profit from (or simply to support) positive ESG practices.

Full integration refers to the inclusion of ESG factors or ESG scores in traditional fundamental analysis. A company's ESG practices are included in the process of estimating fundamental variables, such as a company's cost of capital or future cash flows. To the extent that ESG practices will affect such variables, integrating them into the analysis can help in determining which companies are currently overpriced or underpriced.

Thematic investing refers to investing in sectors or companies in an attempt to promote specific ESG-related goals, such as more sustainable practices in agriculture, greater use of cleaner energy sources, improved management of water resources, or the reduction of carbon emissions.

Engagement/active ownership investing refers to using ownership of company shares or other securities as a platform to promote improved ESG practices. Share ownership is used to initiate or support (through share voting) positive ESG changes. Contact with senior management or board members to promote such changes is also an active ownership strategy. Recently, this strategy has been used to promote reduction in a company's carbon footprint,

increased wages, or other social and environmental goals, which may or may not be associated with improved financial results over time.

Another approach to ESG investing is **green finance**. Green finance refers to producing economic growth in a more sustainable way by reducing emissions and better managing natural resource use. An important part of green finance is the issuance of **green bonds**, bonds for which the funds raised are used for projects with a positive environmental impact. Issuance of green bonds has increased significantly in recent years, led by issuance in the United States and in China, which is prioritizing improvement in environmental conditions.

Overlay/portfolio tilt strategies are used by fund and portfolio managers to manage the ESG characteristics of their overall portfolios. For example, a fund manager may seek to reduce the environmental pollution or carbon footprint of their portfolio stocks as a whole. **Risk factor/risk premium** investing refers to the treatment of ESG factors as an additional source of systemic factor risk, along with such traditional risk factors as firm size and momentum.



MODULE QUIZ 31.2

To best evaluate your performance, enter your quiz answers online.

1. Which of the following statements concerning corporate takeovers is *most accurate*?
 - A. Staggered board elections are considered an anti-takeover measure.
 - B. A proxy fight refers to a move by management to take away voting rights from an activist shareholder.
 - C. A takeover not supported by management is termed hostile, while a takeover supported by management is termed a tender offer.
2. Benefits of effective corporate governance and stakeholder management *most likely* include:
 - A. reduced risk of default.
 - B. more efficient related-party transactions.
 - C. greater control exercised by the most-interested stakeholders.
3. Executive compensation and bonuses are *most likely* consistent with the interests of shareholders if they are:
 - A. stable over time.
 - B. aligned with the company's strategy.
 - C. sufficiently high relative to the company's competitors.
4. The method of ESG integration that does not exclude any sectors but seeks to invest in the companies with the best practices regarding employee rights and environmental sustainability is:
 - A. thematic investing.
 - B. positive screening.
 - C. negative screening.

KEY CONCEPTS

LOS 31.a

Corporate governance refers to the internal controls and procedures of a company that delineate the rights and responsibilities of various groups and how conflicts of interest among the various groups are to be resolved.

LOS 31.b

The primary stakeholders of a corporation include shareholders, the board of directors, senior management, employees, creditors, and suppliers.

LOS 31.c

The principal-agent relationship refers to owners employing agents to act in their interests. Conflicts can arise because the agent's incentives may not align with those of the owner or, more generally, because the interests of one group within a corporation are not the same as those of other groups.

LOS 31.d

Stakeholder management refers to the management of the company relations with stakeholders and is based on having a good understanding of stakeholder interests and maintaining effective communication with stakeholders.

LOS 31.e

The management of stakeholder relationships is based on a company's legal, contractual, organizational, and government infrastructures.

LOS 31.f

The duties of a board of directors include:

- Selecting senior management, setting their compensation, and evaluating their performance.
- Setting the strategic direction for the company.
- Approving capital structure changes, significant acquisitions, and large investment expenditures.
- Reviewing company performance and implementing any necessary corrective steps.
- Planning for continuity of management and the succession of the CEO.
- Establishing, monitoring, and overseeing the firm's internal controls and risk management.
- Ensuring the quality of the firm's financial reporting and internal audit.

LOS 31.g

Factors that can affect stakeholder relationships and corporate governance include:

- Communication and engagement with shareholders.
- Shareholder activism.
- Threat of hostile takeover and existence of anti-takeover provisions.
- Company's legal environment.

- Growth of firms that advise funds on proxy voting and rate companies' corporate governance.

LOS 31.h

The risks of poor governance include weak control systems, poor decision making, legal risk, reputational risk, and default risk. Good corporate governance can improve operational efficiency and performance, reduce default risk, reduce the cost of debt, improve financial performance, and increase firm value.

LOS 31.i

Elements of corporate governance that analysts have found to be relevant include ownership and voting structures, board composition, management remuneration, the composition of shareholders, strength of shareholder rights, and management of long-term risks.

LOS 31.j

The use of environmental, social, and governance (ESG) factors in making investment decisions is referred to as ESG investing. Many issues can be considered in this context, including harm or potential harm to the environment, risk of loss due to environmental accidents, the changing demographics of the workforce, and reputational risks from corrupt practices or human rights abuses.

LOS 31.k

Methods of integrating ESG concerns or factors in portfolio construction include:

- Negative screening.
- Positive screening.
- Relative/best-in-class investing.
- Full integration.
- Thematic investing.
- Green finance/green bond investments.
- Overlay/portfolio tilt investing.
- Risk factor/risk premium investing.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 31.1

1. **B** Stakeholder theory focuses on the conflicts of interest among owners and several groups that have an interest in a company's activities, including creditors. (LOS 31.a)
2. **C** Information asymmetry can exist between a company's shareholders and its managers because the company's managers may be much more knowledgeable about the company's functioning and strategic direction. This makes it more difficult for shareholders to monitor the firm's managers and determine whether they are acting in shareholders' interests. (LOS 31.b)
3. **C** The ability to manage the conflicting interests of company relations with stakeholders requires good communication with stakeholders and a good understanding of their various interests. (LOS 31.c)
4. **B** A company's contractual infrastructure refers to the contracts between the company and its stakeholders that specify the rights and responsibilities of each party. (LOS 31.d)
5. **C** With cumulative voting, shareholders get a vote for each share they own times the number of director elections each year and can give all their votes to a single candidate for the board. This helps minority stockholders to get more proportional representation on the board of directors. (LOS 31.e)
6. **A** Ordinary resolutions, such as those to appoint an auditor or elect a board member, require a simple majority. Acquisitions, mergers, takeovers, and amendments to the company bylaws often require a supermajority of more than 50% for passage. (LOS 31.e)
7. **C** The investment committee reviews proposals for large acquisitions or projects and also monitors the performance of acquired assets and of projects requiring large capital expenditures. (LOS 31.f)

Module Quiz 31.2

1. **A** Because staggered board elections make it more difficult for activist shareholders to gain control of a board of directors, they are considered an anti-takeover measure. A proxy fight is an attempt to convince shareholders to vote a certain way. A tender offer can be made in the context of a takeover, whether hostile or otherwise. (LOS 31.g)
2. **A** Reduced risk of default is among the benefits of effective corporate governance. Risks from poor corporate governance include related-party transactions by managers and opportunities for some stakeholder groups to gain advantage at the expense of others. (LOS 31.h)
3. **B** Executive compensation should be designed to align management's incentives with the interests and objectives of the shareholders. Executive compensation that is stable over time may indicate that executives' performance targets are easy to achieve. High

compensation relative to comparable companies may be a concern, especially if the company's performance has not been better than its peers. (LOS 31.i)

4. **B** Positive screening does not exclude any sectors but seeks to invest in the companies with the best practices. Negative screening typically excludes some sectors. Thematic investing refers to making an investment in a company or project in order to advance specific social or environmental goals. (LOS 31.j, 31.k)

1. www.cfainstitute.org/learning/products/publications/readings/Pages/the_corporate_governance_of_listed_companies_a_manual_for_investors.aspx

The following is a review of the Corporate Finance (1) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #32.

READING 32: CAPITAL BUDGETING

Study Session 10

EXAM FOCUS

If you recollect little from your basic financial management course in college (or if you didn't take one), you will need to spend some time on this review and go through the examples quite carefully. To be prepared for the exam, you need to know how to calculate all of the measures used to evaluate capital projects and the decision rules associated with them. Be sure you can interpret an NPV profile; one could be given as part of a question. Finally, know the reasoning behind the facts that (1) IRR and NPV give the same accept/reject decision for a single project and (2) IRR and NPV can give conflicting rankings for mutually exclusive projects.

MODULE 32.1: CAPITAL PROJECTS, NPV, AND IRR



Video covering this content is available online.

LOS 32.a: Describe the capital budgeting process and distinguish among the various categories of capital projects.

CFA® Program Curriculum, Volume 4, page 48

The **capital budgeting process** is the process of identifying and evaluating capital projects, that is, projects where the cash flow to the firm will be received over a period longer than a year. Any corporate decisions with an impact on future earnings can be examined using this framework. Decisions about whether to buy a new machine, expand business in another geographic area, move the corporate headquarters to Cleveland, or replace a delivery truck, to name a few, can be examined using a capital budgeting analysis.

For a number of good reasons, capital budgeting may be the most important responsibility that a financial manager has. First, because a capital budgeting decision often involves the purchase of costly long-term assets with lives of many years, the decisions made may determine the future success of the firm. Second, the principles underlying the capital budgeting process also apply to other corporate decisions, such as working capital management and making strategic mergers and acquisitions. Finally, making good capital budgeting decisions is consistent with management's primary goal of maximizing shareholder value.

The capital budgeting process has four administrative steps:

Step 1: Idea generation. The most important step in the capital budgeting process is generating good project ideas. Ideas can come from a number of sources including senior management, functional divisions, employees, or sources outside the company.

Step 2: Analyzing project proposals. Because the decision to accept or reject a capital project is based on the project's expected future cash flows, a cash flow forecast must be made for

each product to determine its expected profitability.

Step 3: Create the firm-wide capital budget. Firms must prioritize profitable projects according to the timing of the project's cash flows, available company resources, and the company's overall strategic plan. Many projects that are attractive individually may not make sense strategically.

Step 4: Monitoring decisions and conducting a post-audit. It is important to follow up on all capital budgeting decisions. An analyst should compare the actual results to the projected results, and project managers should explain why projections did or did not match actual performance. Because the capital budgeting process is only as good as the estimates of the inputs into the model used to forecast cash flows, a post-audit should be used to identify systematic errors in the forecasting process and improve company operations.

Categories of Capital Budgeting Projects

Capital budgeting projects may be divided into the following categories:

- *Replacement projects to maintain the business* are normally made without detailed analysis. The only issues are whether the existing operations should continue and, if so, whether existing procedures or processes should be maintained.
- *Replacement projects for cost reduction* determine whether equipment that is obsolete, but still usable, should be replaced. A fairly detailed analysis is necessary in this case.
- *Expansion projects* are taken on to grow the business and involve a complex decision-making process because they require an explicit forecast of future demand. A very detailed analysis is required.
- *New product or market development* also entails a complex decision-making process that will require a detailed analysis due to the large amount of uncertainty involved.
- *Mandatory projects* may be required by a governmental agency or insurance company and typically involve safety-related or environmental concerns. These projects typically generate little to no revenue, but they accompany new revenue-producing projects undertaken by the company.
- *Other projects.* Some projects are not easily analyzed through the capital budgeting process. Such projects may include a pet project of senior management (e.g., corporate perks) or a high-risk endeavor that is difficult to analyze with typical capital budgeting assessment methods (e.g., research and development projects).

LOS 32.b: Describe the basic principles of capital budgeting.

CFA® Program Curriculum, Volume 4, page 50

The capital budgeting process involves five key principles:

1. *Decisions are based on cash flows, not accounting income.* The relevant cash flows to consider as part of the capital budgeting process are **incremental cash flows**, the changes in cash flows that will occur if the project is undertaken.

Sunk costs are costs that cannot be avoided, even if the project is not undertaken. Because these costs are not affected by the accept/reject decision, they should not be included in the analysis. An example of a sunk cost is a consulting fee paid to a

marketing research firm to estimate demand for a new product prior to a decision on the project.

Externalities are the effects the acceptance of a project may have on other firm cash flows. The primary one is a negative externality called **cannibalization**, which occurs when a new project takes sales from an existing product. When considering externalities, the full implication of the new project (loss in sales of existing products) should be taken into account. An example of cannibalization is when a soft drink company introduces a diet version of an existing beverage. The analyst should subtract the lost sales of the existing beverage from the expected new sales of the diet version when estimated incremental project cash flows. A positive externality exists when doing the project would have a positive effect on sales of a firm's other product lines.

A project has a **conventional cash flow pattern** if the sign on the cash flows changes only once, with one or more cash outflows followed by one or more cash inflows. An **unconventional cash flow pattern** has more than one sign change. For example, a project might have an initial investment outflow, a series of cash inflows, and a cash outflow for asset retirement costs at the end of the project's life.

2. *Cash flows are based on opportunity costs.* **Opportunity costs** are cash flows that a firm will lose by undertaking the project under analysis. These are cash flows generated by an asset the firm already owns that would be forgone if the project under consideration is undertaken. Opportunity costs should be included in project costs. For example, when building a plant, even if the firm already owns the land, the cost of the land should be charged to the project because it could be sold if not used.
3. *The timing of cash flows is important.* Capital budgeting decisions account for the time value of money, which means that cash flows received earlier are worth more than cash flows to be received later.
4. *Cash flows are analyzed on an after-tax basis.* The impact of taxes must be considered when analyzing all capital budgeting projects. Firm value is based on cash flows they get to keep, not those they send to the government.
5. *Financing costs are reflected in the project's required rate of return.* Do not consider financing costs specific to the project when estimating incremental cash flows. The discount rate used in the capital budgeting analysis takes account of the firm's cost of capital. Only projects that are expected to return more than the cost of the capital needed to fund them will increase the value of the firm.

LOS 32.c: Explain how the evaluation and selection of capital projects is affected by mutually exclusive projects, project sequencing, and capital rationing.

CFA® Program Curriculum, Volume 4, page 51

Independent vs. mutually exclusive projects

Independent projects are projects that are unrelated to each other and allow for each project to be evaluated based on its own profitability. For example, if projects A and B are independent, and both projects are profitable, then the firm could accept both projects.

Mutually exclusive means that only one project in a set of possible projects can be accepted and that the projects compete with each other. If projects A and B were mutually exclusive, the firm could accept either Project A or Project B, but not both. A capital budgeting decision

between two different stamping machines with different costs and output would be an example of choosing between two mutually exclusive projects.

Project sequencing

Some projects must be undertaken in a certain order, or sequence, so that investing in a project today creates the opportunity to invest in other projects in the future. For example, if a project undertaken today is profitable, that may create the opportunity to invest in a second project a year from now. However, if the project undertaken today turns out to be unprofitable, the firm will not invest in the second project.

Unlimited funds vs. capital rationing

If a firm has unlimited access to capital, the firm can undertake all projects with expected returns that exceed the cost of capital. Many firms have constraints on the amount of capital they can raise and must use *capital rationing*. If a firm's profitable project opportunities exceed the amount of funds available, the firm must ration, or prioritize, its capital expenditures with the goal of achieving the maximum increase in value for shareholders given its available capital.

LOS 32.d: Calculate and interpret net present value (NPV), internal rate of return (IRR), payback period, discounted payback period, and profitability index (PI) of a single capital project.

CFA® Program Curriculum, Volume 4, page 52

Net Present Value (NPV)

Net present value (NPV) is the sum of the present values of all the expected incremental cash flows if a project is undertaken. The discount rate used is the firm's cost of capital, adjusted for the risk level of the project. For a normal project, with an initial cash outflow followed by a series of expected after-tax cash inflows, the NPV is the present value of the expected inflows minus the initial cost of the project.

$$NPV = CF_0 + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \dots + \frac{CF_n}{(1+k)^n} = \sum_{t=0}^n \frac{CF_t}{(1+k)^t}$$

where:

CF_0 = initial investment outlay (a negative cash flow)

CF_t = after-tax cash flow at time t

k = required rate of return for project

A positive NPV project is expected to increase shareholder wealth, a negative NPV project is expected to decrease shareholder wealth, and a zero NPV project has no expected effect on shareholder wealth.

For *independent* projects, the *NPV decision rule* is simply to accept any project with a positive NPV and to reject any project with a negative NPV.

EXAMPLE: Net present value

Using the project cash flows presented in Table 1, compute the NPV of the project and determine whether it should be accepted or rejected. Assume that the cost of capital is 9%.

Table 1: Expected Net After-Tax Cash Flows

Year	Cash Flow
0	−\$100
1	25
2	50
3	75

Answer:

$$\text{NPV} = -100 + \frac{25}{1.09} + \frac{50}{(1.09)^2} + \frac{75}{(1.09)^3} = 22.93$$

The project has a positive NPV, so it should be accepted.

You may calculate NPV directly by using the cash flow (CF) keys on your calculator. The process is illustrated in Table 2 and Table 3.

Table 2: Calculating NPV With the TI Business Analyst II Plus

Keystrokes	Explanation	Display
[CF] [2nd] [CLR WORK]	Clear memory registers	CF0 = 0.0000
100 [+/-] [ENTER]	Initial cash outlay	CF0 = −100.0000
[↓] 25 [ENTER]	Period 1 cash flow	C01 = 25.0000
[↓]	Frequency of cash flow 1	F01 = 1.0000
[↓] 50 [ENTER]	Period 2 cash flow	C02 = 50.0000
[↓]	Frequency of cash flow 2	F02 = 1.0000
[↓] 75 [ENTER]	Period 3 cash flow	C03 = 75.0000
[↓]	Frequency of cash flow 3	F03 = 1.0000
[NPV] 9 [ENTER]	9% discount rate	I = 9.0000
[↓] [CPT]	Calculate NPV	NPV = 22.9335

Table 3: Calculating NPV With the HP 12C

Keystrokes	Explanation	Display
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[f] [FIN] [f] [REG]	Clear memory registers	0.0000
100 [CHS] [g] [CF0]	Initial cash outlay	-100.0000
25 [g] [CFj]	Period 1 cash flow	25.0000
50 [g] [CFj]	Period 2 cash flow	50.0000
75 [g] [CFj]	Period 3 cash flow	75.0000
9 [i]	9% discount rate	9.0000
[f] [NPV]	Calculate NPV	22.9335

Internal Rate of Return (IRR)

For a normal project, the **internal rate of return** (IRR) is the discount rate that makes the present value of the expected incremental after-tax cash inflows just equal to the initial cost of the project. More generally, the IRR is the discount rate that makes the present values of a project's estimated cash inflows equal to the present value of the project's estimated cash outflows. That is, IRR is the discount rate that makes the following relationship hold:

$$PV(\text{inflows}) = PV(\text{outflows})$$

The IRR is also the discount rate for which the NPV of a project is equal to zero:

$$NPV = 0 = CF_0 + \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \dots + \frac{CF_n}{(1+IRR)^n} = \sum_{t=0}^n \frac{CF_t}{(1+IRR)^t}$$

To calculate the IRR, you may use the trial-and-error method. That is, just keep guessing IRRs until you get the right one, or you may use a financial calculator.

IRR decision rule: First, determine the required rate of return for a given project. This is usually the firm's cost of capital. Note that the required rate of return may be higher or lower than the firm's cost of capital to adjust for differences between project risk and the firm's average project risk.

If $IRR >$ the required rate of return, accept the project.

If $IRR <$ the required rate of return, reject the project.

For this reason, the minimum IRR that a firm requires internally for a project to be accepted is often referred to as the **hurdle rate**. Projects with IRRs above this rate will be accepted, while those with IRRs below this rate will not be accepted.

EXAMPLE: Internal rate of return

Continuing with the cash flows presented in Table 1 for the previous example, compute the IRR of the project and determine whether it should be accepted or rejected. Assume that the required rate of return is 9%.

Answer:

$$0 = -100 + \frac{25}{(1+IRR)} + \frac{50}{(1+IRR)^2} + \frac{75}{(1+IRR)^3}$$

The cash flows should be entered as in Table 2 or Table 3 (if you haven't changed or cleared them, they are still there from the calculation of NPV).

With the TI calculator, the IRR can be calculated with:

[IRR] [CPT] to get 19.4377%.

With the HP 12C, the IRR can be calculated with:

[f] [IRR].

The project should be accepted because its IRR is greater than the 9% required rate of return.



MODULE QUIZ 32.1

To best evaluate your performance, enter your quiz answers online.

1. The post-audit is used to:
 - A. improve cash flow forecasts and stimulate management to improve operations and bring results into line with forecasts.
 - B. improve cash flow forecasts and eliminate potentially profitable but risky projects.
 - C. stimulate management to improve operations, bring results into line with forecasts, and eliminate potentially profitable but risky projects.
2. Which of the following statements concerning the principles underlying the capital budgeting process is *most accurate*?
 - A. Cash flows should be based on opportunity costs.
 - B. Financing costs should be reflected in a project's incremental cash flows.
 - C. The net income for a project is essential for making a correct capital budgeting decision.

Use the following data for Questions 3 and 4.

An analyst has gathered the following data about two projects, each with a 12% required rate of return.

	Project Y	Project Z
Initial cost	\$15,000	\$20,000
Life	5 years	4 years
Cash inflows	\$5,000/year	\$7,500/year

3. If the projects are independent, the company should:
 - A. accept Project Y and reject Project Z.
 - B. reject Project Y and accept Project Z.
 - C. accept both projects.
4. If the projects are mutually exclusive, the company should:
 - A. reject both projects.
 - B. accept Project Y and reject Project Z.
 - C. reject Project Y and accept Project Z.
5. Which of the following statements about NPV and IRR is *least accurate*?
 - A. The IRR can be positive even if the NPV is negative.
 - B. When the IRR is equal to the cost of capital, the NPV will be zero.
 - C. The NPV will be positive if the IRR is less than the cost of capital.

Use the following data to answer Questions 6 and 7.

A company is considering the purchase of a copier that costs \$5,000. Assume a required rate of return of 10% and the following cash flow schedule:

- Year 1: \$3,000.
- Year 2: \$2,000.
- Year 3: \$2,000.

6. What is the project's NPV?
- A. −\$309.
 - B. +\$883.
 - C. +\$1,523.
7. The project's IRR is *closest* to:
- A. 10%.
 - B. 15%.
 - C. 20%.

MODULE 32.2: PAYBACK PERIOD, PROJECT RANKINGS



Video covering
this content is
available online.

Payback Period

The **payback period** (PBP) is the number of years it takes to recover the initial cost of an investment.

EXAMPLE: Payback period

Calculate the payback period for the project presented in Table 1. Note the Year 0 cash flow represents the initial cost of the project.

Answer:

The cumulative net cash flow is just the running total of the cash flows at the end of each time period. Payback will occur when the cumulative net cash flow equals zero. To find the payback period, we construct Table 4.

Table 4: Cumulative Net Cash Flows

Year	0	1	2	3
Net cash flow	−100	25	50	75
Cumulative net cash flow	−100	−75	−25	+50

The payback period is determined from Table 4 as follows:

$$\begin{aligned} \text{payback period} &= \text{full years until recovery} \\ &+ \frac{\text{unrecovered cost at beginning of recovery year}}{\text{cash flow during recovery year}} \end{aligned}$$

$$\text{payback period} = 2 + \frac{25}{75} = 2.33 \text{ years}$$

Because the payback period is a measure of liquidity, for a firm with liquidity concerns, the shorter a project's payback period, the better. However, project decisions should not be made on the basis of their payback periods because of the method's drawbacks.

The main drawbacks of the payback period are that it does not take into account either the time value of money or cash flows beyond the payback period, which means terminal or salvage value wouldn't be considered. These drawbacks mean that the payback period is useless as a measure of profitability.

The main benefit of the payback period is that it is a good measure of project liquidity. Firms with limited access to additional liquidity often impose a maximum payback period and then use a measure of profitability, such as NPV or IRR, to evaluate projects that satisfy this maximum payback period constraint.



PROFESSOR'S NOTE

If you have the Professional model of the TI calculator, you can easily calculate the payback period and the discounted payback period (which follows). Once NPV is displayed, use the down arrow to scroll through NFV (net future value), to PB (payback), and DPB (discounted payback). You must use the compute key when "PB=" is displayed. If the annual net cash flows are equal, the payback period is simply project cost divided by the annual cash flow.

Discounted Payback Period

The **discounted payback period** uses the present values of the project's estimated cash flows. It is the number of years it takes a project to recover its initial investment in present value terms and, therefore, must be greater than the payback period without discounting.

EXAMPLE: Discounted payback period

Calculate the discounted payback period for the project presented in Table 1. Assume the firm's cost of capital is 9%.

Answer:

Table 5: Discounted Net Cash Flows

Year	0	1	2	3
Net cash flow	-100	25	50	75
Discounted net cash flow	-100	22.94	42.08	57.91
Cumulative discounted net cash flow	-100	-77.06	-34.98	+22.93

$$\text{discounted payback period} = 2 + \frac{34.98}{57.91} = 2.60 \text{ years}$$

The discounted payback period addresses one of the drawbacks of the payback period by discounting cash flows at the project's required rate of return. However, the discounted payback period still does not consider any cash flows beyond the payback period, which means that it is a poor measure of profitability. Again, its use is primarily as a measure of liquidity.

Profitability Index (PI)

The **profitability index** (PI) is the present value of a project's future cash flows divided by the initial cash outlay:

$$PI = \frac{\text{PV of future cash flows}}{CF_0} = 1 + \frac{NPV}{CF_0}$$

The profitability index is related closely to net present value. The NPV is the difference between the present value of future cash flows and the initial cash outlay, and the PI is the ratio of the present value of future cash flows to the initial cash outlay.

If the NPV of a project is positive, the PI will be greater than one. If the NPV is negative, the PI will be less than one. It follows that the *decision rule* for the PI is:

If $PI > 1.0$, accept the project.

If $PI < 1.0$, reject the project.

EXAMPLE: Profitability index

Calculate the profitability index for the project presented in Table 1. Assume the firm's cost of capital is 9%.

Answer:

$$\text{PV future cash flows} = \frac{25}{1.09} + \frac{50}{(1.09)^2} + \frac{75}{(1.09)^3} = 122.93$$

$$\text{profitability index} = \frac{122.93}{100} = 1.2293$$

Accept the project because $PI > 1$.



PROFESSOR'S NOTE

The accept/reject decision rule here is exactly equivalent to both the NPV and IRR decision rules. That is, if $PI > 1$, then the NPV must be positive, and the IRR must be greater than the discount rate. Note also that once you have the NPV, you can just add back the initial outlay to get the PV of the cash inflows used here.

LOS 32.e: Explain the NPV profile, compare the NPV and IRR methods when evaluating independent and mutually exclusive projects, and describe the problems associated with each of the evaluation methods.

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A project's **NPV profile** is a graph that shows a project's NPV for different discount rates. The discount rates are on the x-axis of the NPV profile, and the corresponding NPVs are plotted on the y-axis. The following example illustrates an NPV profile for two projects.

EXAMPLE: NPV profile

Using the project cash flows presented in Table 6, construct an NPV profile for Project A and Project B.

Table 6: Project Cash Flows

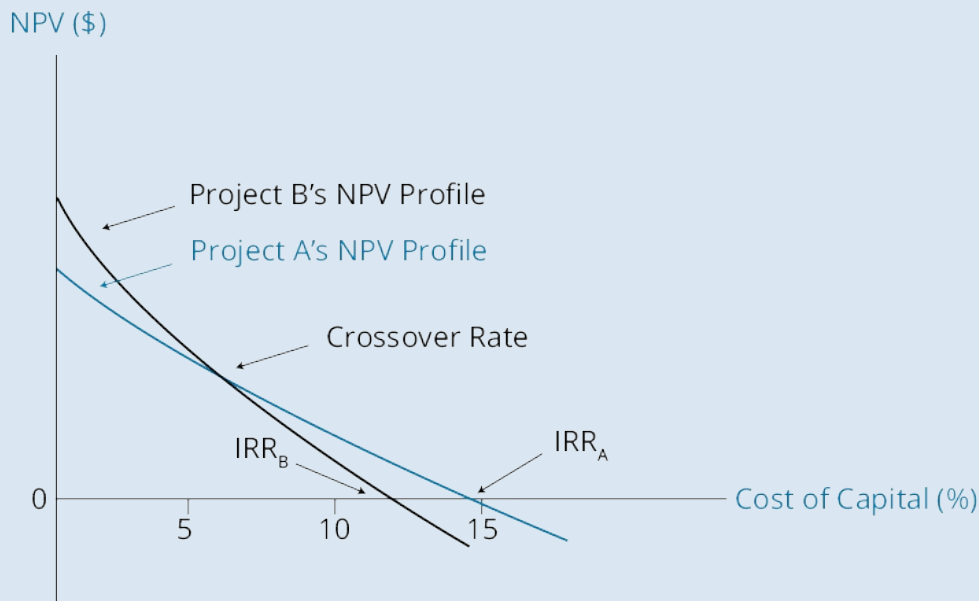
Year	Project A	Project B
0	−\$2,000	−\$2,000
1	1,000	200
2	800	600

3	600	800
4	200	1,200

Answer:

The NPV profiles are presented in [Figure 32.1](#). The project NPVs are summarized in the table following this graph.

Figure 32.1: NPV Profiles



Discount Rate	NPV _A	NPV _B
0%	600.00	800.00
5%	360.84	413.00
10%	157.64	98.36
15%	(16.66)	(160.28)

Note in the example that the projects' IRRs are the discount rates where the NPV profiles intersect the x-axis, because these are the discount rates for which NPV equals zero. Recall that the IRR is the discount rate that results in an NPV of zero.

Also notice in [Figure 32.1](#) that the NPV profiles intersect. They intersect at the discount rate for which NPVs of the projects are equal, 7.2%. This rate at which the NPVs are equal is called the **crossover rate**. At discount rates below 7.2% (to the left of the intersection), Project B has the greater NPV, and at discount rates above 7.2%, Project A has a greater NPV. Clearly, the discount rate used in the analysis can determine which one of two mutually exclusive projects will be accepted.

The NPV profiles for projects A and B intersect because of a difference in the timing of the cash flows. Examining the cash flows for the projects (Table 1), we can see that the total cash inflows for Project B are greater (\$2,800) than those of Project A (\$2,600). Because they both

have the same initial cost (\$2,000) at a discount rate of zero, Project B has a greater NPV ($2,800 - 2,000 = \$800$) than Project A ($2,600 - 2,000 = \600).

We can also see that the cash flows for Project B come later in the project's life. That's why the NPV of Project B falls faster than the NPV of Project A as the discount rate increases, and the NPVs are eventually equal at a discount rate of 7.2%. At discount rates above 7.2%, the fact that the total cash flows of Project B are greater in nominal dollars is overridden by the fact that Project B's cash flows come later in the project's life than those of Project A.

The Relative Advantages and Disadvantages of the NPV and IRR Methods

A **key advantage of NPV** is that it is a direct measure of the expected increase in the value of the firm. NPV is theoretically the best method. Its main weakness is that it does not include any consideration of the size of the project. For example, an NPV of \$100 is great for a project costing \$100 but not so great for a project costing \$1 million.

A **key advantage of IRR** is that it measures profitability as a percentage, showing the return on each dollar invested. The IRR provides information on the margin of safety that the NPV does not. From the IRR, we can tell how much below the IRR (estimated return) the actual project return could fall, in percentage terms, before the project becomes uneconomic (has a negative NPV).

The *disadvantages* of the IRR method are (1) the possibility of producing rankings of mutually exclusive projects different from those from NPV analysis and (2) the possibility that a project has multiple IRRs or no IRR.

LOS 32.f: Contrast the NPV decision rule to the IRR decision rule and identify problems associated with the IRR rule.

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Conflicting project rankings

Consider two projects with an initial investment of €1,000 and a required rate of return of 10%. Project X will generate cash inflows of €500 at the end of each of the next five years. Project Y will generate a single cash flow of €4,000 at the end of the fifth year.

Year	Project X	Project Y
0	-€1,000	-€1,000
1	500	0
2	500	0
3	500	0
4	500	0
5	500	4,000

NPV	€895	€1,484
IRR	41.0%	32.0%

Project X has a higher IRR, but Project Y has a higher NPV. Which is the better project? If Project X is selected, the firm will be worth €895 more because the PV of the expected cash flows is €895 more than the initial cost of the project. Project Y, however, is expected to increase the value of the firm by €1,484. Project Y is the better project. Because NPV measures the expected increase in wealth from undertaking a project, NPV is the only acceptable criterion when ranking projects.

Another reason, besides cash flow timing differences, that NPV and IRR may give conflicting project rankings is differences in project size. Consider two projects, one with an initial outlay of \$100,000, and one with an initial outlay of \$1 million. The smaller project may have a higher IRR, but the increase in firm value (NPV) may be small compared to the increase in firm value (NPV) of the larger project, even though its IRR is lower.

It is sometimes said that the NPV method implicitly assumes that project cash flows can be reinvested at the discount rate used to calculate NPV. This is a realistic assumption, because it is reasonable to assume that project cash flows could be used to reduce the firm's capital requirements. Any funds that are used to reduce the firm's capital requirements allow the firm to avoid the cost of capital on those funds. Just by reducing its equity capital and debt, the firm could "earn" its cost of capital on funds used to reduce its capital requirements. If we were to rank projects by their IRRs, we would be implicitly assuming that project cash flows could be reinvested at the project's IRR. This is unrealistic and, strictly speaking, if the firm could earn that rate on invested funds, that rate should be the one used to discount project cash flows.

The "multiple IRR" and "no IRR" problems

If a project has cash outflows during its life or at the end of its life in addition to its initial cash outflow, the project is said to have an unconventional cash flow pattern. Projects with such cash flows may have more than one IRR (there may be more than one discount rate that will produce an NPV equal to zero).

It is also possible to have a project where there is no discount rate that results in a zero NPV, that is, the project does not have an IRR. A project with no IRR may actually be a profitable project. The lack of an IRR results from the project having unconventional cash flows, where mathematically, no IRR exists. NPV does not have this problem and produces theoretically correct decisions for projects with unconventional cash flow patterns.

Neither of these problems can arise with the NPV method. If a project has non-normal cash flows, the NPV method will give the appropriate accept/reject decision.

LOS 32.g: Describe expected relations among an investment's NPV, company value, and share price.

Because the NPV method is a direct measure of the expected change in firm value from undertaking a capital project, it is also the criterion most related to stock prices. In theory, a positive NPV project should cause a proportionate increase in a company's stock price.

In reality, the impact of a project on the company's stock price is more complicated than the previous example. A company's stock price is a function of the present value of its expected future earnings stream. As a result, changes in the stock price will result more from changes in *expectations* about a firm's positive NPV projects. If a company announces a project for which managers expect a positive NPV but analysts expect a lower level of profitability from the project than the company does (e.g., an acquisition), the stock price may actually drop on the announcement. As another example, a project announcement may be taken as a signal about other future capital projects, raising expectations and resulting in a stock price increase that is much greater than what the NPV of the announced project would justify.



MODULE QUIZ 32.2

To best evaluate your performance, enter your quiz answers online.

Use the following data to answer Questions 1 through 3.

A company is considering the purchase of a copier that costs \$5,000. Assume a required rate of return of 10% and the following cash flow schedule:

- Year 1: \$3,000.
- Year 2: \$2,000.
- Year 3: \$2,000.

1. What is the project's payback period?
 - A. 1.5 years.
 - B. 2.0 years.
 - C. 2.5 years.
2. The project's discounted payback period is *closest* to:
 - A. 1.4 years.
 - B. 2.0 years.
 - C. 2.4 years.
3. What is the project's profitability index (PI)?
 - A. 0.72.
 - B. 1.18.
 - C. 1.72.
4. Which of the following statements about the payback period method is *least accurate*? The payback period:
 - A. provides a rough measure of a project's liquidity.
 - B. considers all cash flows throughout the entire life of a project.
 - C. is the number of years it takes to recover the original cost of the investment.
5. Which of the following statements is *least accurate*? The discounted payback period:
 - A. frequently ignores terminal values.
 - B. is generally shorter than the regular payback.
 - C. is the time it takes for the present value of the project's cash inflows to equal the initial cost of the investment.
6. The NPV profiles of two projects will intersect:
 - A. at their internal rates of return.
 - B. if they have different discount rates.
 - C. at the discount rate that makes their net present values equal.
7. Which of the following statements *most accurately* describes the IRR and NPV methods?
 - A. A project's NPV may be positive even if the IRR is less than the cost of capital.

- B. If the NPV and IRR methods give conflicting decisions for mutually exclusive projects, the IRR decision should be used to select the project.
 - C. The NPV method assumes that a project's cash flows will be reinvested at the cost of capital, while the IRR method assumes they will be reinvested at the IRR.
8. Fullen Machinery is investing \$400 million in new industrial equipment. The present value of the future after-tax cash flows resulting from the equipment is \$700 million. Fullen currently has 200 million shares of common stock outstanding, with a current market price of \$36 per share. Assuming that this project is new information and is independent of other expectations about the company, what is the theoretical effect of the new equipment on Fullen's stock price? The stock price will:
- A. decrease to \$33.50.
 - B. increase to \$37.50.
 - C. increase to \$39.50.

KEY CONCEPTS

LOS 32.a

Capital budgeting is the process of evaluating capital projects, projects with cash flows over more than one year.

The four steps of the capital budgeting process are: (1) Generate investment ideas; (2) Analyze project ideas; (3) Create firm-wide capital budget; and (4) Monitor decisions and conduct a post-audit.

Categories of capital projects include: (1) Replacement projects for maintaining the business or for cost reduction; (2) Expansion projects; (3) New product or market development; (4) Mandatory projects to meet environmental or regulatory requirements; (5) Other projects, such as research and development or pet projects of senior management.

LOS 32.b

Capital budgeting decisions should be based on incremental after-tax cash flows, the expected differences in after-tax cash flows if a project is undertaken. Sunk (already incurred) costs are not considered, but externalities and cash opportunity costs must be included in project cash flows.

LOS 32.c

Acceptable independent projects can all be undertaken, while a firm must choose between or among mutually exclusive projects.

Project sequencing concerns the opportunities for future capital projects that may be created by undertaking a current project.

If a firm cannot undertake all profitable projects because of limited ability to raise capital, the firm should choose that group of fundable positive NPV projects with the highest total NPV.

LOS 32.d

NPV is the sum of the present values of a project's expected cash flows and represents the increase in firm value from undertaking a project. Positive NPV projects should be undertaken, but negative NPV projects are expected to decrease the value of the firm.

The IRR is the discount rate that equates the present values of the project's expected cash inflows and outflows and, thus, is the discount rate for which the NPV of a project is zero. A project for which the IRR is greater (less) than the discount rate will have an NPV that is positive (negative) and should be accepted (not be accepted).

The payback (discounted payback) period is the number of years required to recover the original cost of the project (original cost of the project in present value terms).

The profitability index is the ratio of the present value of a project's future cash flows to its initial cash outlay and is greater than one when a project's NPV is positive.

LOS 32.e

An NPV profile plots a project's NPV as a function of the discount rate, and it intersects the horizontal axis (NPV = 0) at its IRR. If two NPV profiles intersect at some discount rate, that

is the crossover rate, and different projects are preferred at discount rates higher and lower than the crossover rate.

LOS 32.f

For projects with conventional cash flow patterns, the NPV and IRR methods produce the same accept/reject decision, but projects with unconventional cash flow patterns can produce multiple IRRs or no IRR.

Mutually exclusive projects can be ranked based on their NPVs, but rankings based on other methods will not necessarily maximize the value of the firm.

LOS 32.g

The NPV method is a measure of the expected change in company value from undertaking a project. A firm's stock price may be affected to the extent that engaging in a project with that NPV was previously unanticipated by investors.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 32.1

1. **A** A post-audit identifies what went right and what went wrong. It is used to improve forecasting and operations. (LOS 32.a)
2. **A** Cash flows are based on opportunity costs. Financing costs are recognized in the project's required rate of return. Accounting net income, which includes non-cash expenses, is irrelevant; incremental cash flows are essential for making correct capital budgeting decisions. (LOS 32.b)
3. **C** Independent projects accept all with positive NPVs or IRRs greater than cost of capital. NPV computation is easy—treat cash flows as an annuity.
Project Y: $N = 5$; $I = 12$; $PMT = 5,000$; $FV = 0$; $CPT \rightarrow PV = -18,024$
 $NPV_A = 18,024 - 15,000 = \$3,024$
Project Z: $N = 4$; $I = 12$; $PMT = 7,500$; $FV = 0$; $CPT \rightarrow PV = -22,780$
 $NPV_B = 22,780 - 20,000 = \$2,780$ (LOS 32.c)
4. **B** Accept the project with the highest NPV. (LOS 32.c)
5. **C** If IRR is less than the cost of capital, the result will be a negative NPV. (LOS 32.d)
6. **B** $CF_0 = -5,000$; $CF_1 = 3,000$; $CF_2 = 2,000$;
 $CF_3 = 2,000$; $I/Y = 10$; $NPV = \$883$. (LOS 32.d)
7. **C** $CF_0 = -5,000$, $CF_1 = 3,000$, $CF_2 = 2,000$, $CF_3 = 2,000$. $IRR = 20.64\%$. (LOS 32.d)

Module Quiz 32.2

1. **B** Cash flow (CF) after year 2 = $-5,000 + 3,000 + 2,000 = 0$. Cost of copier is paid back in the first two years. (LOS 32.d)
2. **C** Year 1 discounted cash flow = $3,000 / 1.10 = 2,727$
Year 2 DCF = $2,000 / 1.10^2 = 1,653$
Year 3 DCF = $2,000 / 1.10^3 = 1,503$
CF required after year 2 = $-5,000 + 2,727 + 1,653 = -\620
 $620 / \text{year 3 DCF} = 620 / 1,503 = 0.41$, for a discounted payback of 2.4 years.
Using a financial calculator:
Year 1: $I = 10\%$; $FV = 3,000$; $N = 1$; $PMT = 0$; $CPT \rightarrow PV = -2,727$
Year 2: $N = 2$; $FV = 2,000$; $CPT \rightarrow PV = -1,653$
Year 3: $N = 3$; $CPT \rightarrow PV = -1,503$
 $5,000 - (2,727 + 1,653) = 620$, $620 / 1,503 = 0.413$, so discounted payback = $2 + 0.4 = 2.4$. (LOS 32.d)

3. **B** $PI = PV \text{ of future cash flows} / CF_0$ (discounted cash flows years 0 to 3 calculated in Question 2). $PI = (2,727 + 1,653 + 1,503) / 5,000 = 1.177$. (LOS 32.d)
4. **B** The payback period ignores cash flows that go beyond the payback period. (LOS 32.d)
5. **B** The discounted payback is longer than the regular payback because cash flows are discounted to their present value. (LOS 32.d)
6. **C** The crossover rate for the NPV profiles of two projects occurs at the discount rate that results in both projects having equal NPVs. (LOS 32.e)
7. **C** The NPV method implicitly assumes that a project's cash flows will be reinvested at the discount rate used to calculate NPV, while the IRR method implicitly assumes cash flows will be reinvested at the IRR. If the IRR is less than the cost of capital, NPV will be negative. If the NPV and IRR methods give conflicting decisions for mutually exclusive projects, the NPV decision should be used to select the project. (LOS 32.f)
8. **B** The NPV of the new equipment is \$700 million – \$400 million = \$300 million. The value of this project is added to Fullen's current market value. On a per-share basis, the addition is worth \$300 million / 200 million shares, for a net addition to the share price of \$1.50. $\$36.00 + \$1.50 = \$37.50$. (LOS 32.g)

The following is a review of the Corporate Finance (1) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #33.

READING 33: COST OF CAPITAL

Study Session 10

EXAM FOCUS

The firm must decide how to raise the capital to fund its business or finance its growth, dividing it among common equity, debt, and preferred stock. The mix that produces the minimum overall cost of capital will maximize the value of the firm (share price). From this topic review, you must understand weighted average cost of capital and its calculation and be ready to calculate the costs of common equity, preferred stock, and the after-tax cost of debt. Don't worry about choosing among the methods for calculating the cost of common equity; the information given in the question will make it clear which one to use. You must know all these methods and understand why the marginal cost of capital increases as greater amounts of capital are raised over a given period (usually taken to be a year).

MODULE 33.1: WEIGHTED AVERAGE COST OF CAPITAL



Video covering this content is available online.

LOS 33.a: Calculate and interpret the weighted average cost of capital (WACC) of a company.

LOS 33.b: Describe how taxes affect the cost of capital from different capital sources.

CFA® Program Curriculum, Volume 4, page 78

The capital budgeting process involves discounted cash flow analysis. To conduct such analysis, you must know the firm's proper discount rate. This topic review discusses how, as an analyst, you can determine the proper rate at which to discount the cash flows associated with a capital budgeting project. This discount rate is the firm's **weighted average cost of capital** (WACC) and is also referred to as the **marginal cost of capital** (MCC).

Basic definitions. On the right (liability) side of a firm's balance sheet, we have debt, preferred stock, and common equity. These are normally referred to as the *capital components* of the firm. Any increase in a firm's total assets will have to be financed through an increase in at least one of these capital accounts. The cost of each of these components is called the *component cost* of capital.

Throughout this review, we focus on the following capital components and their component costs:

- k_d The rate at which the firm can issue new debt. This is the yield to maturity on existing debt. This is also called the before-tax component cost of debt.
- $k_d(1 - t)$ The after-tax cost of debt. Here, t is the firm's marginal tax rate. The after-tax component cost of debt, $k_d(1 - t)$, is used to calculate the WACC.
- The cost of preferred stock.

k_{ps}

k_{ce} The cost of common equity. It is the required rate of return on common stock and is generally difficult to estimate.

In many countries, the interest paid on corporate debt is tax deductible. Because we are interested in the after-tax cost of capital, we adjust the cost of debt, k_d , for the firm's marginal tax rate, t . Because there is typically no tax deduction allowed for payments to common or preferred stockholders, there is no equivalent deduction to k_{ps} or k_{ce} .

How a company raises capital and how it budgets or invests it are considered independently. Most companies have separate departments for the two tasks. The financing department is responsible for keeping costs low and using a balance of funding sources: common equity, preferred stock, and debt. Generally, it is necessary to raise each type of capital in large sums. The large sums may temporarily overweight the most recently issued capital, but in the long run, the firm will adhere to target weights. Because of these and other financing considerations, each investment decision must be made assuming a WACC, which includes each of the different sources of capital and is based on the long-run target weights. A company creates value by producing a return on assets that is higher than the required rate of return on the capital needed to fund those assets.

The WACC, as we have described it, is the cost of financing firm assets. We can view this cost as an opportunity cost. Consider how a company could reduce its costs if it found a way to produce its output using fewer assets, like less working capital. If we need less working capital, we can use the funds freed up to buy back our debt and equity securities in a mix that just matches our target capital structure. Our after-tax savings would be the WACC based on our target capital structure multiplied by the total value of the securities that are no longer outstanding.

For these reasons, any time we are considering a project that requires expenditures, comparing the return on those expenditures to the WACC is the appropriate way to determine whether undertaking that project will increase the value of the firm. This is the essence of the capital budgeting decision. Because a firm's WACC reflects the average risk of the projects that make up the firm, it is not appropriate for evaluating all new projects. It should be adjusted upward for projects with greater-than-average risk and downward for projects with less-than-average risk.

The weights in the calculation of a firm's WACC are the proportions of each source of capital in a firm's capital structure.

Calculating a Company's Weighted Average Cost of Capital

The WACC is given by:

$$\text{WACC} = (w_d)[k_d(1 - t)] + (w_{ps})(k_{ps}) + (w_{ce})(k_{ce})$$

where:

w_d = percentage of debt in the capital structure

w_{ps} = percentage of preferred stock in the capital structure

w_{ce} = percentage of common stock in the capital structure

EXAMPLE: Computing WACC

Suppose Dexter, Inc.'s target capital structure is as follows:

$$w_d = 0.45, w_{ps} = 0.10, \text{ and } w_{ce} = 0.45$$

Its before-tax cost of debt is 7.5%, its cost of equity is 11.5%, its cost of preferred stock is 9.0%, and its marginal tax rate is 40%. Calculate Dexter's WACC.

Answer:

Dexter's WACC will be:

$$\text{WACC} = (w_d)(k_d)(1 - t) + (w_{ps})(k_{ps}) + (w_{ce})(k_{ce})$$

$$\text{WACC} = (0.45)(0.075)(0.6) + (0.10)(0.09) + (0.45)(0.115) = 0.081 = 8.1\%$$

LOS 33.c: Describe the use of target capital structure in estimating WACC and how target capital structure weights may be determined.

CFA® Program Curriculum, Volume 4, page 80

The weights in the calculation of WACC should be based on the firm's target capital structure; that is, the proportions (based on market values) of debt, preferred stock, and equity that the firm expects to achieve over time. An analyst may use the stated target proportions of equity and debt provided by firm management. In the absence of any explicit information about a firm's target capital structure from the firm itself, an analyst may simply use the firm's current capital structure (based on market values) as the best indication of its target capital structure. If there has been a noticeable trend in the firm's capital structure, the analyst may want to incorporate this trend into his estimate of the firm's target capital structure. For example, if a firm has been reducing its proportion of debt financing each year for two or three years, the analyst may wish to use a weight on debt that is lower than the firm's current weight on debt in constructing the firm's target capital structure.

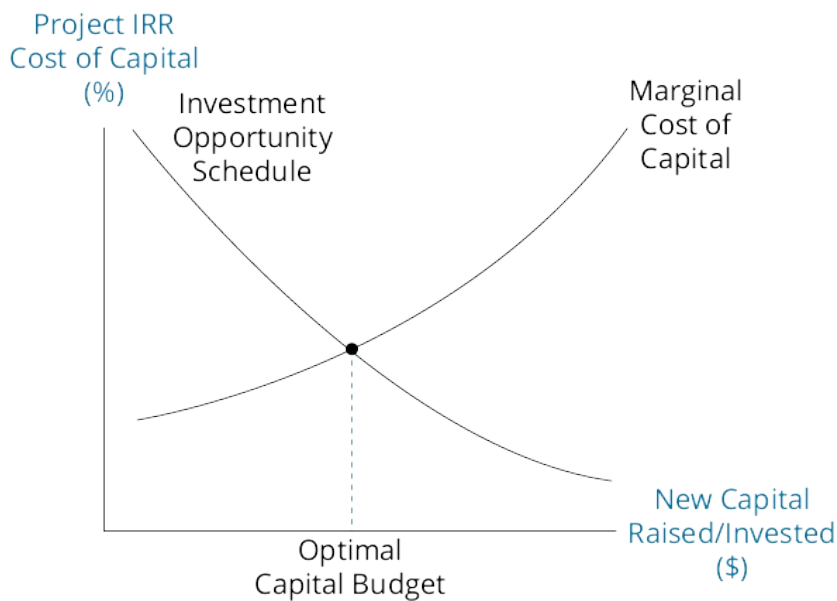
Alternatively, an analyst may wish to use the industry average capital structure as the target capital structure for a firm under analysis.

LOS 33.d: Explain how the marginal cost of capital and the investment opportunity schedule are used to determine the optimal capital budget.

CFA® Program Curriculum, Volume 4, page 82

A company increases its value and creates wealth for its shareholders by earning more on its investment in assets than is required by those who provide the capital for the firm. A firm's WACC may increase as larger amounts of capital are raised. Thus, its marginal cost of capital, the cost of raising additional capital, can increase as larger amounts are invested in new projects. This is illustrated by the upward-sloping **marginal cost of capital curve** in [Figure 33.1](#). Given the expected returns (IRRs) on potential projects, we can order the expenditures on additional projects from highest to lowest IRR. This will allow us to construct a downward sloping **investment opportunity schedule**, such as that shown in [Figure 33.1](#).

Figure 33.1: The Optimal Capital Budget



The intersection of the investment opportunity schedule with the marginal cost of capital curve identifies the amount of the **optimal capital budget**. The intuition here is that the firm should undertake all those projects with IRRs greater than the cost of funds, the same criterion developed in the capital budgeting topic review. This will maximize the value created. At the same time, no projects with IRRs less than the marginal cost of the additional capital required to fund them should be undertaken, as they will erode the value created by the firm.

LOS 33.e: Explain the marginal cost of capital's role in determining the net present value of a project.

CFA® Program Curriculum, Volume 4, page 82

One cautionary note regarding the simple logic behind [Figure 33.1](#) is in order. All projects do not have the same risk. The WACC is the appropriate discount rate for projects that have approximately the same level of risk as the firm's existing projects. This is because the component costs of capital used to calculate the firm's WACC are based on the existing level of firm risk. To evaluate a project with greater than (the firm's) average risk, a discount rate greater than the firm's existing WACC should be used. Projects with below-average risk should be evaluated using a discount rate less than the firm's WACC.

An additional issue to consider when using a firm's WACC (marginal cost of capital) to evaluate a specific project is that there is an implicit assumption that the capital structure of the firm will remain at the target capital structure over the life of the project.

These complexities aside, we can still conclude that the NPVs of potential projects of firm-average risk should be calculated using the marginal cost of capital for the firm. Projects for which the present value of the after-tax cash inflows is greater than the present value of the after-tax cash outflows should be undertaken by the firm.

LOS 33.f: Calculate and interpret the cost of debt capital using the yield-to-maturity approach and the debt-rating approach.

CFA® Program Curriculum, Volume 4, page 84

The **after-tax cost of debt**, $k_d(1 - t)$, is used in computing the WACC. It is the interest rate at which firms can issue new debt (k_d) net of the tax savings from the tax deductibility of interest, $k_d(t)$:

$$\text{after-tax cost of debt} = \text{interest rate} - \text{tax savings} = k_d - k_d(t) = k_d(1 - t)$$

$$\text{after-tax cost of debt} = k_d(1 - t)$$

EXAMPLE: Cost of debt

Dexter, Inc., is planning to issue new debt at an interest rate of 7.5%. Dexter has a 40% marginal federal-plus-state tax rate. What is Dexter's cost of debt capital?

Answer:

$$k_d(1 - t) = 7.5\%(1 - 0.4) = 4.5\%$$



PROFESSOR'S NOTE

It is important that you realize that the cost of debt is the market interest rate (YTM) on new (marginal) debt, not the coupon rate on the firm's existing debt. CFA Institute may provide you with both rates, and you need to select the current market rate.

In tax jurisdictions where interest payments are not deductible for tax purposes, t is zero, and the pretax and after-tax cost of debt are the same.

It may be that interest is tax deductible but the amount of the deduction is capped at some maximum. In this case, if the firm's interest costs will be less than the maximum tax-deductible amount if a project is undertaken, the appropriate cost of debt is the after-tax cost based on the firm's tax rate. For a project that would require debt interest payments in excess of the maximum tax-deductible amount, the appropriate cost of debt is the pretax cost, as no additional tax deductions for interest on debt are permitted.

If a market YTM is not available because the firm's debt is not publicly traded, the analyst may use the rating and maturity of the firm's existing debt to estimate the before-tax cost of debt. If, for example, the firm's debt carries a single-A rating and has an average maturity of 15 years, the analyst can use the yield curve for single-A rated debt to determine the current market rate for debt with a 15-year maturity. This approach is an example of **matrix pricing** or valuing a bond based on the yields of comparable bonds.

If any characteristics of the firm's anticipated debt would affect the yield (e.g., covenants or seniority), the analyst should make the appropriate adjustment to his estimated before-tax cost of debt. For firms that primarily employ floating-rate debt, the analyst should estimate the longer-term cost of the firm's debt using the current yield curve (term structure) for debt of the appropriate rating category.

LOS 33.g: Calculate and interpret the cost of noncallable, nonconvertible preferred stock.

CFA® Program Curriculum, Volume 4, page 86

The **cost of preferred stock** (k_{ps}) is:

$$k_{ps} = D_{ps} / P$$

where:

D_{ps} = preferred dividends

P = market price of preferred

EXAMPLE: Cost of preferred stock

Suppose Dexter, Inc., has preferred stock that pays an \$8.50 dividend per share and sells for \$100 per share. What is Dexter's cost of preferred stock?

Answer:

$$k_{ps} = D_{ps} / P$$

$$k_{ps} = \$8.50 / \$100 = 0.085 = 8.5\%$$

Note that the equation $k_{ps} = D_{ps} / P$ is just a rearrangement of the preferred stock valuation model $P = D_{ps} / k_{ps}$, where P is the market price.

LOS 33.h: Calculate and interpret the cost of equity capital using the capital asset pricing model approach, the dividend discount model approach, and the bond-yield-plus risk-premium approach.

CFA® Program Curriculum, Volume 4, page 88

The opportunity **cost of equity capital** (k_{ce}) is the required rate of return on the firm's common stock. The rationale here is that the firm could avoid part of the cost of common stock outstanding by using retained earnings to buy back shares of its own stock. The cost of (i.e., the required return on) common equity can be estimated using one of the following three approaches:

1. The **capital asset pricing model approach**.

Step 1: Estimate the risk-free rate, R_f . Yields on default risk-free debt such as U.S. Treasury notes are usually used. The most appropriate maturity to choose is one that is close to the useful life of the project.

Step 2: Estimate the stock's beta, β . This is the stock's risk measure.

Step 3: Estimate the expected rate of return on the market, $E(R_{mkt})$.

Step 4: Use the capital asset pricing model (CAPM) equation to estimate the required rate of return:

$$k_{ce} = R_f + \beta[E(R_{mkt}) - R_f]$$

EXAMPLE: Using CAPM to estimate k_{ce}

Suppose $R_f = 5\%$, $R_{mkt} = 11\%$, and Dexter has a beta of 1.1. Estimate Dexter's cost of equity.

Answer:

The required rate of return for Dexter's stock is:

$$k_{ce} = 5\% + 1.1(11\% - 5\%) = 11.6\%$$



PROFESSOR'S NOTE

If you are unfamiliar with the capital asset pricing model, you can find more detail and the basic elements of its derivation in the Study Session on portfolio management.

2. **The dividend discount model approach.** If dividends are expected to grow at a constant rate, g , then the current value of the stock is given by the dividend growth model:

$$P_0 = \frac{D_1}{k_{ce} - g}$$

where:

D_1 = next year's dividend

k_{ce} = required rate of return on common equity

g = firm's expected constant growth rate

Rearranging the terms, you can solve for k_{ce} :

$$k_{ce} = \frac{D_1}{P_0} + g$$

In order to use $k_{ce} = \frac{D_1}{P_0} + g$, you have to estimate the expected growth rate, g . This can be done by:

- Using the growth rate as projected by security analysts.
- Using the following equation to estimate a firm's sustainable growth rate:

$$g = (\text{retention rate})(\text{return on equity}) = (1 - \text{payout rate})(\text{ROE})$$

The difficulty with this model is estimating the firm's future growth rate.

EXAMPLE: Estimating k_{ce} using the dividend discount model

Suppose Dexter's stock sells for \$21, next year's dividend is expected to be \$1, Dexter's expected ROE is 12%, and Dexter is expected to pay out 40% of its earnings. What is Dexter's cost of equity?

Answer:

$$g = (\text{ROE})(\text{retention rate})$$

$$g = (0.12)(1 - 0.4) = 0.072 = 7.2\%$$

$$k_{ce} = (1 / 21) + 0.072 = 0.12 \text{ or } 12\%$$

3. **Bond yield plus risk premium approach.** Analysts often use an ad hoc approach to estimate the required rate of return. They add a risk premium (three to five percentage points) to the market yield on the firm's long-term debt.

$$k_{ce} = \text{bond yield} + \text{risk premium}$$

EXAMPLE: Estimating k_{ce} with bond yields plus a risk premium

Dexter's interest rate on long-term debt is 7.5%. Suppose the risk premium is estimated to be 4%. Estimate Dexter's cost of equity.

Answer:

Dexter's estimated cost of equity is:

$$k_{ce} = 7.5\% + 4.0\% = 11.5\%$$

Note that the three models gave us three different estimates of k_{ce} . The CAPM estimate was 11.6%, the dividend discount model estimate was 12%, and the bond yield plus risk premium estimate was 11.5%. Analysts must use their judgment to decide which is most appropriate.



MODULE QUIZ 33.1

To best evaluate your performance, enter your quiz answers online.

1. An analyst gathered the following data about a company:

Capital Structure	Required Rate of Return
30% debt	10% for debt
20% preferred stock	11% for preferred stock
50% common stock	18% for common stock

Assuming a 40% tax rate, what after-tax rate of return must the company earn on its investments?

- A. 13.0%.
 - B. 14.2%.
 - C. 18.0%.
2. A company is planning a \$50 million expansion. The expansion is to be financed by selling \$20 million in new debt and \$30 million in new common stock. The before-tax required return on debt is 9% and 14% for equity. If the company is in the 40% tax bracket, the company's marginal cost of capital is *closest to*:
 - A. 7.2%.
 - B. 10.6%.
 - C. 12.0%.
 3. What happens to a company's weighted average cost of capital (WACC) if the firm's corporate tax rate increases and if the Federal Reserve causes an increase in the risk-free rate, respectively? (Consider the events independently and assume a beta of less than one.)

<u>Tax rate increase</u>	<u>Increase in risk-free rate</u>
A. Decrease WACC	Increase WACC
B. Decrease WACC	Decrease WACC
C. Increase WACC	Increase WACC
 4. Flynn Company has a capital structure of 40% debt, 50% common equity, and 10% preferred equity, based on market values. Firms in Flynn's industry have on average 30% debt, 55% common equity, and 15% preferred equity. Flynn's management intends to issue equity shares to bring the proportion of common equity up to 55% and keep the proportion of preferred equity at 10%. To estimate Flynn's WACC, an analyst should use a weight of debt:
 - A. equal to 35%.
 - B. less than 35%.
 - C. greater than 35%.
 5. An investment opportunity schedule is most accurately described as illustrating all the projects:
 - A. available to a company.
 - B. that will add value to a company.
 - C. within a company's optimal capital budget.
 6. To evaluate a project with less risk than the average risk of a company's existing projects, an analyst should discount its cash flows at an interest rate:
 - A. equal to the company's WACC.
 - B. less than the company's WACC.

- C. greater than the company's WACC.
7. A company has \$5 million in debt outstanding with a coupon rate of 12%. Currently, the yield to maturity (YTM) on these bonds is 14%. If the firm's tax rate is 40%, what is the company's after-tax cost of debt?
 - A. 5.6%.
 - B. 8.4%.
 - C. 14.0%.
 8. A company's \$100, 8% preferred is currently selling for \$85. What is the company's cost of preferred equity?
 - A. 8.0%.
 - B. 9.4%.
 - C. 10.8%.
 9. The expected dividend is \$2.50 for a share of stock priced at \$25. What is the cost of equity if the long-term growth in dividends is projected to be 8%?
 - A. 15%.
 - B. 16%.
 - C. 18%.

MODULE 33.2: PROJECT COST OF CAPITAL



Video covering
this content is
available online.

LOS 33.i: Calculate and interpret the beta and cost of capital for a project.

CFA® Program Curriculum, Volume 4, page 94

A **project's beta** is a measure of its systematic or market risk. Just as we can use a firm's beta to estimate its required return on equity, we can use a project's beta to adjust for differences between a specific project's risk and the average risk of a firm's projects.

Because a specific project is not represented by a publicly traded security, we typically cannot estimate a project's beta directly. One process that can be used is based on the equity beta of a publicly traded firm that is engaged in a business similar to, and with risk similar to, the project under consideration. This is referred to as the **pure-play method** because we begin with the beta of a company or group of companies that are *purely* engaged in a business similar to that of the project and are therefore comparable to the project. Thus, using the beta of a conglomerate that is engaged in the same business as the project would be inappropriate because its beta depends on its many different lines of business.

The beta of a firm is a function not only of the business risks of its projects (lines of business) but also of its financial structure. For a given set of projects, the greater a firm's reliance on debt financing, the greater its equity beta. For this reason, we must adjust the pure-play beta from a comparable company (or group of companies) for the company's leverage (unlever it) and then adjust it (re-lever it) based on the financial structure of the company evaluating the project. We can then use this equity beta to calculate the cost of equity to be used in evaluating the project.

To get the *asset beta* for a publicly traded firm, we use the following formula:

$$\beta_{\text{ASSET}} = \beta_{\text{EQUITY}} \left\{ \frac{1}{1 + \left[(1-t) \frac{D}{E} \right]} \right\}$$

where:

D/E = *comparable company's* debt-to-equity ratio and t is its marginal tax rate

To get the equity beta for the project, we use the *subject firm's* tax rate and debt-to-equity ratio:

$$\beta_{\text{PROJECT}} = \beta_{\text{ASSET}} \left\{ 1 + \left[(1 - t) \frac{D}{E} \right] \right\}$$

The following example illustrates this technique.

EXAMPLE: Cost of capital for a project

Acme, Inc., is considering a project in the food distribution business. It has a D/E ratio of 2, a marginal tax rate of 40%, and its debt currently has a yield of 14%. Balfor, a publicly traded firm that operates only in the food distribution business, has a D/E ratio of 1.5, a marginal tax rate of 30%, and an equity beta of 0.9. The risk-free rate is 5%, and the expected return on the market portfolio is 12%. Calculate Balfor's asset beta, the project's equity beta, and the appropriate WACC to use in evaluating the project.

Answer:

Balfor's asset beta:

$$\beta_{\text{ASSET}} = 0.9 \left[\frac{1}{1 + (1 - 0.3)(1.5)} \right] = 0.439$$

Equity beta for the project:

$$\beta_{\text{PROJECT}} = 0.439[1 + (1 - 0.4)(2)] = 0.966$$

Project cost of equity = 5% + 0.966(12% - 5%) = 11.762%

To get the weights of debt and equity, use the D/E ratio and give equity a value of 1. Here, D/E = 2, so if E = 1, D = 2. The weight for debt, D/(D + E), is 2/(2 + 1) = 2/3, and the weight for equity, E/(D + E), is 1/(2 + 1) = 1/3. The appropriate WACC for the project is therefore:

$$\frac{1}{3}(11.762\%) + \frac{2}{3}(14\%)(1 - 0.4) = 9.52\%$$

While the method is theoretically correct, there are several challenging issues involved in estimating the beta of the comparable (or any) company's equity:

- Beta is estimated using historical returns data. The estimate is sensitive to the length of time used and the frequency (daily, weekly, etc.) of the data.
- The estimate is affected by which index is chosen to represent the market return.
- Betas are believed to revert toward 1 over time, and the estimate may need to be adjusted for this tendency.
- Estimates of beta for small-capitalization firms may need to be adjusted upward to reflect risk inherent in small firms that is not captured by the usual estimation methods.

LOS 33.j: Describe uses of country risk premiums in estimating the cost of equity.

CFA® Program Curriculum, Volume 4, page 101

Using the CAPM to estimate the cost of equity is problematic in developing countries because beta does not adequately capture country risk. To reflect the increased risk associated with investing in a developing country, a **country risk premium** is added to the market risk premium when using the CAPM.

The general risk of the developing country is reflected in its **sovereign yield spread**. This is the difference in yields between the developing country's government bonds (denominated in the developed market's currency) and Treasury bonds of a similar maturity. To estimate an

equity risk premium for the country, adjust the sovereign yield spread by the ratio of volatility between the country's equity market and its government bond market (for bonds denominated in the developed market's currency). A more volatile equity market increases the country risk premium, other things equal.

The revised CAPM equation is stated as:

$$k_{ce} = R_f + \beta[E(R_{MKT}) - R_f + CRP]$$

where:

CRP = country risk premium

The country risk premium can be calculated as:

$$CRP = \text{sovereign yield spread} \times \left(\frac{\text{annualized standard deviation of equity index of developing country}}{\text{annualized standard deviation of sovereign bond market in terms of the developed market currency}} \right)$$

where:

sovereign yield spread = difference between the yields of government bonds in the developing country and Treasury bonds of similar maturities

LOS 33.k: Describe the marginal cost of capital schedule, explain why it may be upward-sloping with respect to additional capital, and calculate and interpret its break-points.

CFA® Program Curriculum, Volume 4, page 102

The **marginal cost of capital (MCC)** is the cost of raising an additional dollar of capital. As a firm raises more and more capital, the costs of a firm's sources of financing can increase. This can occur, for example, if bond covenants in the firm's existing senior debt prohibit the firm from issuing additional debt with the same seniority as the existing debt. In this case, the company would have to issue subordinated bonds at a higher cost of debt, which increases the marginal cost of capital.

Raising greater amounts through equity issuance can also increase the cost of equity and, therefore, the marginal cost of capital.

The marginal cost of capital can also be increased when capital is not raised in proportions that exactly match the target capital weights. Because of perceived capital market opportunities or economies of scale in issuing more debt or more equity, a firm's capital structure may differ from target weights. These temporary deviations may increase a firm's cost of capital. The bottom line is that raising additional capital results in an increase in the WACC.

The **marginal cost of capital schedule** shows the WACC for different amounts of financing. Typically, the MCC is shown as a graph. Because different sources of financing become more expensive as the firm raises more capital, the MCC schedule typically has an upward slope.

Break points occur any time the cost of one of the components of the company's WACC changes. A break point is calculated as:

$$\text{break point} = \frac{\text{amount of capital at which the component's cost of capital changes}}{\text{weight of the component in the capital structure}}$$

EXAMPLE: Calculating break points

The Omni Corporation has a target capital structure of 60% equity and 40% debt. The schedule of financing costs for the Omni Corporation is shown in the following figure.

Schedule of Capital Costs for Omni

Amount of New Debt (in millions)	After-Tax Cost of Debt	Amount of New Equity (in millions)	Cost of Equity
\$0 to \$99	4.2%	\$0 to \$199	6.5%
\$100 to \$199	4.6%	\$200 to \$399	8.0%
\$200 to \$299	5.0%	\$400 to \$599	9.5%

Calculate the break points for Omni Corporation and graph the marginal cost of capital schedule.

Answer:

Omni will have a break point each time a component cost of capital changes, for a total of four break points.

$$\text{break point}_{\text{debt} > \$100\text{mm}} = \frac{\$100 \text{ million}}{0.4} = \$250 \text{ million}$$

$$\text{break point}_{\text{debt} > \$200\text{mm}} = \frac{\$200 \text{ million}}{0.4} = \$500 \text{ million}$$

$$\text{break point}_{\text{equity} > \$200\text{mm}} = \frac{\$200 \text{ million}}{0.6} = \$333 \text{ million}$$

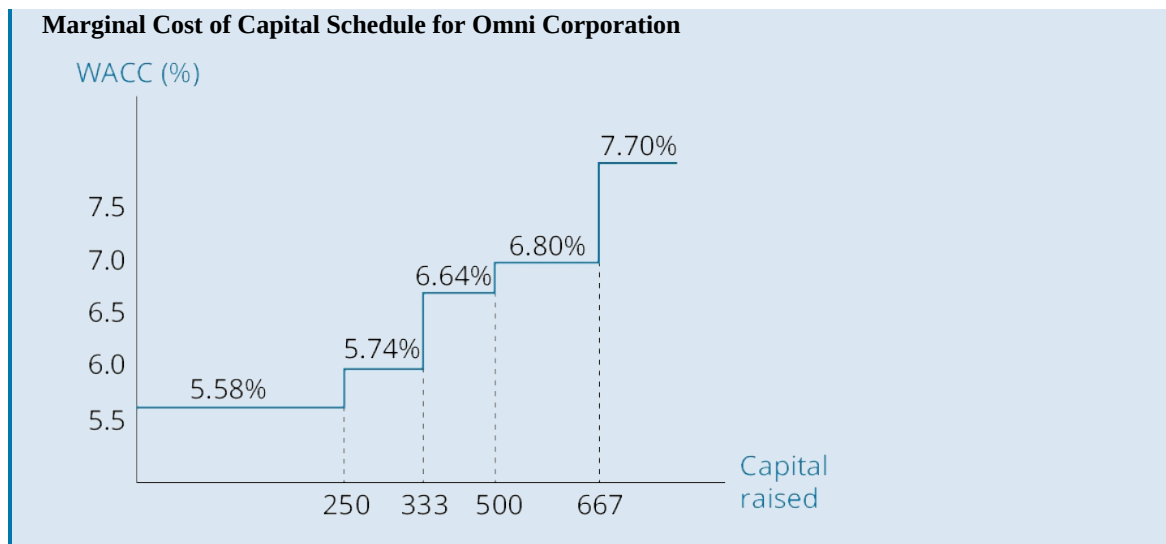
$$\text{break point}_{\text{equity} > \$400\text{mm}} = \frac{\$400 \text{ million}}{0.6} = \$667 \text{ million}$$

The following figure shows Omni Corporation's WACC for the different break points.

WACC for Alternative Levels of Financing

Capital (in millions)	Equity (60%)	Cost of Equity	Debt (40%)	Cost of Debt	WACC
\$50	\$30	6.5%	\$20	4.2%	5.58%
\$250	\$150	6.5%	\$100	4.6%	5.74%
\$333	\$200	8.0%	\$133	4.6%	6.64%
\$500	\$300	8.0%	\$200	5.0%	6.80%
\$667	\$400	9.5%	\$267	5.0%	7.70%

The following figure is a graph of the marginal cost of capital schedule given in the previous figure. Notice the upward slope of the line due to the increased financing costs as more financing is needed.



LOS 33.I: Explain and demonstrate the correct treatment of flotation costs.

CFA® Program Curriculum, Volume 4, page 105

Flotation costs are the fees charged by investment bankers when a company raises external equity capital. Flotation costs can be substantial and often amount to between 2% and 7% of the total amount of equity capital raised, depending on the type of offering.

Incorrect Treatment of Flotation Costs

Because the LOS asks for the “correct treatment of flotation costs,” that implies that there is an incorrect treatment. Many financial textbooks incorporate flotation costs directly into the cost of capital by increasing the cost of external equity. For example, if a company has a dividend of \$1.50 per share, a current price of \$30 per share, and an expected growth rate of 6%, the cost of equity without flotation costs would be:

$$r_e = \left(\frac{\$1.50(1+0.06)}{\$30} \right) + 0.06 = 0.1130, \text{ or } 11.30\%$$



PROFESSOR'S NOTE

Here we're using the constant growth model, rather than the CAPM, to estimate the cost of equity.

If we incorporate flotation costs of 4.5% directly into the cost of equity computation, the cost of equity increases:

$$r_e = \left[\frac{\$1.50(1+0.06)}{\$30(1-0.045)} \right] + 0.06 = 0.1155, \text{ or } 11.55\%$$

Correct Treatment of Flotation Costs

In the *incorrect* treatment we have just seen, flotation costs effectively increase the WACC by a fixed percentage and will be a factor for the duration of the project because future project cash flows are discounted at this higher WACC to determine project NPV. The problem with this approach is that flotation costs are not an ongoing expense for the firm. Flotation costs are a cash outflow that occurs at the initiation of a project and affect the project NPV by increasing the initial cash outflow. Therefore, *the correct way to account for flotation costs is to adjust the initial project cost*. An analyst should calculate the dollar

amount of the flotation cost attributable to the project and increase the initial cash outflow for the project by this amount.

EXAMPLE: Correctly accounting for flotation costs

Omni Corporation is considering a project that requires a \$400,000 cash outlay and is expected to produce cash flows of \$150,000 per year for the next four years. Omni's tax rate is 35%, and the before-tax cost of debt is 6.5%. The current share price for Omni's stock is \$36 per share, and the expected dividend next year is \$2 per share. Omni's expected growth rate is 5%. Assume that Omni finances the project with 50% debt and 50% equity capital and that flotation costs for equity are 4.5%. The appropriate discount rate for the project is the WACC.

Calculate the NPV of the project using the correct treatment of flotation costs and discuss how the result of this method differs from the result obtained from the incorrect treatment of flotation costs.

Answer:

$$\text{after-tax cost of debt} = 6.5\%(1 - 0.35) = 4.23\%$$

$$\text{cost of equity} = \left(\frac{\$2}{\$36} \right) + 0.05 = 0.1055, \text{ or } 10.55\%$$

$$\text{WACC} = 0.50(0.0423) + 0.50(0.1055) = 7.39\%$$

Because the project is financed with 50% equity, the amount of equity capital raised is $0.50 \times \$400,000 = \$200,000$.

Flotation costs are 4.5%, which equates to a dollar cost of $\$200,000 \times 0.045 = \$9,000$.

$$\begin{aligned} \text{NPV} &= -\$400,000 - \$9,000 + \frac{\$150,000}{1.0739} + \frac{\$150,000}{(1.0739)^2} \\ &\quad + \frac{\$150,000}{(1.0739)^3} + \frac{\$150,000}{(1.0739)^4} = \$94,640 \end{aligned}$$

For comparison, if we would have adjusted the cost of equity for flotation costs, the cost of equity would have increased to

$$10.82\% \left(= \frac{\$2.00}{\$36(1 - 0.045)} + 0.05 \right), \text{ which would have increased the WACC}$$

to 7.53%. Using this method, the NPV of the project would have been:

$$\begin{aligned} \text{NPV} &= -\$400,000 + \frac{\$150,000}{1.0753} + \frac{\$150,000}{(1.0753)^2} \\ &\quad + \frac{\$150,000}{(1.0753)^3} + \frac{\$150,000}{(1.0753)^4} = \$102,061 \end{aligned}$$

The two methods result in significantly different estimates for the project NPV. Adjusting the initial outflow for the dollar amount of the flotation costs is the correct approach because it provides the most accurate assessment of the project's value once all costs are considered.

Note that flotation costs may be tax-deductible for some firms. In that case, the initial cash flow of the project should be adjusted by the after-tax flotation cost. In this example, Omni would have an after-tax flotation cost of $\$9,000(1 - 0.35) = \$5,850$ and the project NPV would be \$97,790.



MODULE QUIZ 33.2

To best evaluate your performance, enter your quiz answers online.

- Jay Company has a debt-to-equity ratio of 2.0. Jay is evaluating the cost of equity for a project in the same line of business as Cass Company (Cass) and will use the pure-play method with Cass as the comparable firm. Cass has a beta of 1.2 and a debt-to-equity ratio of 1.6. The project beta *most likely*:
 - will be less than Jay Company's beta.
 - will be greater than Jay Company's beta.
 - could be greater than or less than Jay Company's beta.

2. Derek Ramsey is an analyst with Bullseye Corporation, a major U.S.-based discount retailer. Bullseye is considering opening new stores in Brazil and wants to estimate its cost of equity capital for this investment. Ramsey has found that:
- The appropriate beta to use for the project is 1.3.
 - The market risk premium is 6%.
 - The risk-free interest rate is 4.5%.
 - The country risk premium for Brazil is 3.1%.

Which of the following is *closest* to the cost of equity that Ramsey should use in his analysis?

- A. 10.5%.
 - B. 15.6%.
 - C. 16.3%.
3. Marginal cost of capital schedules slope upward because raising additional capital:
- A. incurs flotation costs.
 - B. increases the cost of debt.
 - C. increases the size of a company.
4. Black Pearl Yachts is considering a project that requires a \$180,000 cash outlay and is expected to produce cash flows of \$50,000 per year for the next five years. Black Pearl's tax rate is 25%, and the before-tax cost of debt is 8%. The current share price for Black Pearl's stock is \$56, and the expected dividend next year is \$2.80 per share. Black Pearl's expected growth rate is 5%. Assume that Black Pearl finances the project with 60% equity and 40% debt, and the flotation cost for equity is 4.0%. The appropriate discount rate is the weighted average cost of capital (WACC). Which of the following choices is *closest* to the dollar amount of the flotation costs and the NPV for the project, assuming that flotation costs are accounted for properly?

	<u>Dollar amount of flotation costs</u>	<u>NPV of project</u>
A.	\$4,320	\$17,548
B.	\$4,320	\$13,228
C.	\$7,200	\$17,548

KEY CONCEPTS

LOS 33.a

$$\text{WACC} = (w_d)(k_d)(1 - t) + (w_{ps})(k_{ps}) + (w_{ce})(k_{ce})$$

The weighted average cost of capital, or WACC, is calculated using weights based on the market values of each component of a firm's capital structure and is the correct discount rate to use to discount the cash flows of projects with risk equal to the average risk of a firm's projects.

LOS 33.b

Interest expense on a firm's debt is tax deductible, so the pre-tax cost of debt must be reduced by the firm's marginal tax rate to get an after-tax cost of debt capital:

$$\text{after-tax cost of debt} = k_d (1 - \text{firm's marginal tax rate})$$

The pre-tax and after-tax capital costs are equal for both preferred stock and common equity because dividends paid by the firm are not tax deductible.

LOS 33.c

WACC should be calculated based on a firm's target capital structure weights.

If information on a firm's target capital structure is not available, an analyst can use the firm's current capital structure, based on market values, or the average capital structure in the firm's industry as estimates of the target capital structure.

LOS 33.d

A firm's marginal cost of capital (WACC at each level of capital investment) increases as it needs to raise larger amounts of capital. This is shown by an upward-sloping marginal cost of capital curve.

An investment opportunity schedule shows the IRRs of (in decreasing order), and the initial investment amounts for, a firm's potential projects.

The intersection of a firm's investment opportunity schedule with its marginal cost of capital curve indicates the optimal amount of capital expenditure, the amount of investment required to undertake all positive NPV projects.

LOS 33.e

The marginal cost of capital (the WACC for additional units of capital) should be used as the discount rate when calculating project NPVs for capital budgeting decisions.

Adjustments to the cost of capital are necessary when a project differs in risk from the average risk of a firm's existing projects. The discount rate should be adjusted upward for higher-risk projects and downward for lower-risk projects.

LOS 33.f

The before-tax cost of fixed-rate debt capital, k_d , is the rate at which the firm can issue new debt.

- The yield-to-maturity approach assumes the before-tax cost of debt capital is the YTM on the firm's existing publicly traded debt.
- If a market YTM is not available, the analyst can use the debt rating approach, estimating the before-tax cost of debt capital based on market yields for debt with the same rating and average maturity as the firm's existing debt.

LOS 33.g

The cost (and yield) of noncallable, nonconvertible preferred stock is simply the annual dividend divided by the market price of preferred shares.

LOS 33.h

The cost of equity capital, k_{ce} , is the required rate of return on the firm's common stock.

There are three approaches to estimating k_{ce} :

- CAPM approach: $k_{ce} = R_f + \beta[E(R_{mkt}) - R_f]$.
- Dividend discount model approach: $k_{ce} = (D_1/P_0) + g$.
- Bond yield plus risk premium approach: add a risk premium of 3% to 5% to the market yield on the firm's long-term debt.

LOS 33.i

When a project's risk differs from that of the firm's average project, we can use the beta of a company or group of companies that are exclusively in the same business as the project to calculate the project's required return. This *pure-play method* involves the following steps:

1. Estimate the beta for a comparable company or companies.
2. Unlever the beta to get the asset beta using the marginal tax rate and debt-to-equity ratio for the comparable company:

$$\beta_{\text{ASSET}} = \beta_{\text{EQUITY}} \left\{ \frac{1}{1 + \left[(1 - t) \frac{D}{E} \right]} \right\}$$

3. Re-lever the beta using the marginal tax rate and debt-to-equity ratio for the firm considering the project:

$$\beta_{\text{PROJECT}} = \beta_{\text{ASSET}} \left\{ 1 + \left[(1 - t) \frac{D}{E} \right] \right\}$$

4. Use the CAPM to estimate the required return on equity to use when evaluating the project.
5. Calculate the WACC for the firm using the project's required return on equity.

LOS 33.j

A country risk premium should be added to the market risk premium in the capital asset pricing model to reflect the added risk associated with investing in a developing market.

LOS 33.k

The marginal cost of capital schedule shows the WACC for successively greater amounts of new capital investment for a period, such as the coming year.

The MCC schedule is typically upward-sloping because raising greater amounts of capital increases the cost of equity and debt financing. Break points (increases) in the marginal cost

of capital schedule occur at amounts of total capital raised equal to the amount of each source of capital at which the component cost of capital increases, divided by the target weight for that source of capital.

LOS 33.I

The correct method to account for flotation costs of raising new equity capital is to increase a project's initial cash outflow by the flotation cost attributable to the project when calculating the project's NPV.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 33.1

1. **A** $WACC = (w_d)(k_d)(1 - t) + (w_{ps})(k_{ps}) + (w_{ce})(k_{ce}) = (0.3)(0.1)(1 - 0.4) + (0.2)(0.11) + (0.5)(0.18) = 13\%$ (LOS 33.a)
2. **B** $w_d = 20 / (20 + 30) = 0.4$, $w_{ce} = 30 / (20 + 30) = 0.6$
 $WACC = (w_d)(k_d)(1 - t) + (w_{ce})(k_{ce}) = (0.4)(9)(1 - 0.4) + (0.6)(14) = 10.56\% = MCC$ (LOS 33.a)
3. **A** An increase in the corporate tax rate will reduce the after-tax cost of debt, causing the WACC to fall. More specifically, because the after-tax cost of debt $= (k_d)(1 - t)$, the term $(1 - t)$ decreases, decreasing the after-tax cost of debt. If the risk-free rate were to increase, the costs of debt and equity would both increase, thus causing the firm's cost of capital to increase. (LOS 33.b)
4. **A** If a company's target capital structure weights are known, an analyst should use them in estimating the company's WACC. Flynn's target weight of debt is $100 - 55 - 10 = 35\%$. (LOS 33.c)
5. **A** An investment opportunity schedule is a ranking of all the projects available to a company, from highest to lowest IRR. Projects that will add value to a company are the portion of an investment opportunity schedule for which project IRRs are greater than the marginal cost of capital (i.e., to the left of the optimal amount of capital investment). (LOS 33.d)
6. **B** A company's WACC reflects the risk of its existing projects. For a less-risky project, a discount rate less than the company's WACC is appropriate. (LOS 33.e)
7. **B** $k_d(1 - t) = (0.14)(1 - 0.4) = 8.4\%$ (LOS 33.f)
8. **B** $k_{ps} = D_{ps} / P_{ps}$, $D_{ps} = \$100 \times 8\% = \8 , $k_{ps} = 8 / 85 = 9.4\%$ (LOS 33.g)
9. **C** Using the dividend yield plus growth rate approach: $k_{ce} = (D_1 / P_0) + g = (2.50 / 25.00) + 8\% = 18\%$. (LOS 33.h)

Module Quiz 33.2

1. **C** The project beta calculated using the pure-play method is not necessarily related in a predictable way to the beta of the firm that is performing the project. (LOS 33.i)
2. **C** $k_e = R_f + \beta[E]R_{MKT} - R_f + CRP$
 $= 0.045 + 1.3 [0.06 + 0.031]$
 $= 0.163$, or 16.3%
Note that the market risk premium refers to the quantity $[E(R_{MKT}) - R_f]$. (LOS 33.j)
3. **B** Marginal cost of capital schedules slope upward because raising additional debt results in a higher required yield, often because of restrictions on issuing new debt with

the same seniority as previously issued debt. It may also slope upward because, in practice, capital is not raised in the exact proportions of the company's capital structure, leading to greater than optimal WACC. (LOS 33.k)

4. **B** Because the project is financed with 60% equity, the amount of equity capital raised is $0.60 \times \$180,000 = \$108,000$.

Flotation costs are 4.0%, which equates to a dollar cost of $\$108,000 \times 0.04 = \$4,320$.

$$\text{after-tax cost of debt} = 8.0\% (1 - 0.25) = 6.0\%$$

$$\text{cost of equity} = \left(\frac{\$2.80}{\$56.00} \right) + 0.05 = 0.10, \text{ or } 10.0\%$$

$$\text{WACC} = 0.60(0.10) + 0.40(0.06) = 8.4\%$$

$$\begin{aligned} \text{NPV} = & -\$180,000 - \$4,320 + \frac{\$50,000}{1.084} + \frac{\$50,000}{(1.084)^2} + \frac{\$50,000}{(1.084)^3} \\ & + \frac{\$50,000}{(1.084)^4} + \frac{\$50,000}{(1.084)^5} = \$13,228 \end{aligned}$$

(LOS 33.l)

The following is a review of the Corporate Finance (2) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #34.

READING 34: MEASURES OF LEVERAGE

Study Session 11

EXAM FOCUS

Here we define and calculate various measures of leverage and the firm characteristics that affect the levels of operating and financial leverage. Operating leverage magnifies the effect of changes in sales on operating earnings. Financial leverage magnifies the effect of changes in operating earnings on net income (earnings per share). The breakeven quantity of sales is that quantity of sales for which total revenue just covers total costs. The operating breakeven quantity of sales is the quantity of sales for which total revenue just covers total operating costs. Be sure you understand how a firm's decisions regarding its operating structure and scale and its decisions regarding the use of debt and equity financing (its capital structure) affect its breakeven levels of sales and the uncertainty regarding its operating earnings and net income.

MODULE 34.1: MEASURES OF LEVERAGE

LOS 34.a: Define and explain leverage, business risk, sales risk, operating risk, and financial risk and classify a risk.



Video covering this content is available online.

CFA[®] Program Curriculum, Volume 4, page 126

Leverage, in the sense we use it here, refers to the amount of fixed costs a firm has. These fixed costs may be fixed operating expenses, such as building or equipment leases, or fixed financing costs, such as interest payments on debt. Greater leverage leads to greater variability of the firm's after-tax operating earnings and net income. A given change in sales will lead to a greater change in operating earnings when the firm employs operating leverage; a given change in operating earnings will lead to a greater change in net income when the firm employs financial leverage.



PROFESSOR'S NOTE

The British refer to leverage as "gearing."

Business risk refers to the risk associated with a firm's operating income and is the result of uncertainty about a firm's revenues and the expenditures necessary to produce those revenues. Business risk is the combination of sales risk and operating risk.

- **Sales risk** is the uncertainty about the firm's sales.
- **Operating risk** refers to the additional uncertainty about operating earnings caused by fixed operating costs. The greater the proportion of fixed costs to variable costs, the greater a firm's operating risk.

Financial risk refers to the additional risk that the firm's common stockholders must bear when a firm uses fixed cost (debt) financing. When a company finances its operations with

debt, it takes on fixed expenses in the form of interest payments. The greater the proportion of debt in a firm's capital structure, the greater the firm's financial risk.

LOS 34.b: Calculate and interpret the degree of operating leverage, the degree of financial leverage, and the degree of total leverage.

CFA® Program Curriculum, Volume 4, page 128

The **degree of operating leverage** (DOL) is defined as the percentage change in operating income (EBIT) that results from a given percentage change in sales:

$$\text{DOL} = \frac{\text{percentage change in EBIT}}{\text{percentage change in sales}} = \frac{\frac{\Delta \text{EBIT}}{\text{EBIT}}}{\frac{\Delta Q}{Q}}$$

To calculate a firm's DOL for a particular level of unit sales, Q, DOL is:

$$\text{DOL} = \frac{Q(P - V)}{Q(P - V) - F}$$

where:

Q = quantity of units sold

P = price per unit

V = variable cost per unit

F = fixed costs

Multiplying, we have:

$$\text{DOL} = \frac{S - \text{TVC}}{S - \text{TVC} - F}$$

where:

S = sales

TVC = total variable costs

F = fixed costs

Note that in this form, the denominator is operating earnings (EBIT).

EXAMPLE: Degree of operating leverage

Atom Company produced 5,000 units last year that it sold for \$75 each. Atom's fixed costs were \$70,000, and its variable cost per unit was \$50. Calculate and interpret Atom's degree of operating leverage at this level of production.

Answer:

$$\text{DOL} = \frac{Q(P - V)}{Q(P - V) - F} = \frac{5,000(\$75 - \$50)}{5,000(\$75 - \$50) - \$70,000}$$

$$\text{DOL} = \frac{\$125,000}{\$55,000} = 2.2727$$

The result indicates that if Atom Company has a 3% increase in sales, its EBIT will increase by $2.2727 \times 3\% = 6.82\%$.

It is important to note that the degree of operating leverage for a company depends on the level of sales. For example, if Atom Company sells 10,000 units, the DOL is decreased:

$$\begin{aligned} \text{DOL (Atom)} &= \frac{Q(P-V)}{[Q(P-V)-F]} = \frac{10,000(\$75-\$50)}{[10,000(\$75-\$50)-\$70,000]} \\ &= \frac{250,000}{180,000} = 1.39 \end{aligned}$$

DOL is highest at low levels of sales and declines at higher levels of sales.

The **degree of financial leverage** (DFL) is interpreted as the ratio of the percentage change in net income (or EPS) to the percentage change in EBIT:

$$\text{DFL} = \frac{\text{percentage change in EPS}}{\text{percentage change in EBIT}}$$

For a particular level of operating earnings, DFL is calculated as:

$$\text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - \text{interest}}$$



PROFESSOR'S NOTE

The terms “earnings per share” (EPS) and “net income” are used interchangeably in this topic review.

EXAMPLE: Degree of financial leverage

From the previous example, Atom Company’s operating income from selling 5,000 units is \$55,000. Assume that Atom has an annual interest expense of \$20,000. Calculate and interpret Atom’s degree of financial leverage.

Answer:

$$\text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - I} = \frac{\$55,000}{\$55,000 - \$20,000} = 1.5714$$

The result indicates that if Atom Company has a 3% increase in EBIT, earnings per share will increase by $1.5714 \times 3\% = 4.71\%$.



PROFESSOR'S NOTE

Look back at the formulas for DOL and DFL and convince yourself that if there are no fixed costs, DOL is equal to one, and that if there are no interest costs, DFL is equal to one. Values of one mean no leverage. No fixed costs, no operating leverage. No interest costs, no financial leverage. This should help tie these formulas to the concepts and help you know when you have the formulas right (or wrong). If you plug in zero for fixed costs, DOL should be one, and if you plug in zero for interest, DFL should be one.

The **degree of total leverage** (DTL) combines the degree of operating leverage and financial leverage. DTL measures the sensitivity of EPS to change in sales. DTL is computed as:

$$\text{DTL} = \text{DOL} \times \text{DFL}$$

$$\text{DTL} = \frac{\% \Delta \text{EBIT}}{\% \Delta \text{sales}} \times \frac{\% \Delta \text{EPS}}{\% \Delta \text{EBIT}} = \frac{\% \Delta \text{EPS}}{\% \Delta \text{sales}}$$

$$\text{DTL} = \frac{Q(P-V)}{Q(P-V)-F-I}$$

$$\text{DTL} = \frac{S - \text{TVC}}{S - \text{TVC} - F - I}$$

EXAMPLE: Degree of total leverage

Continuing with our previous example, calculate Atom Company's degree of total leverage and determine how much Atom's EPS will increase if its sales increase by 10%.

Answer:

$$DTL = DOL \times DFL = 2.2727 \times 1.5714 = 3.5713$$

Alternatively,

$$DTL = \frac{S - TVC}{S - TVC - F - I} = \frac{\$375,000 - \$250,000}{\$375,000 - \$250,000 - \$70,000 - \$20,000} = 3.5714$$

The result indicates that if Atom Company has a 10% increase in sales, earnings per share will increase by $3.5714 \times 10\% = 35.714\%$.

LOS 34.c: Analyze the effect of financial leverage on a company's net income and return on equity.

CFA® Program Curriculum, Volume 4, page 137

The use of financial leverage significantly increases the risk and potential reward to common stockholders. The following examples involving Beta Company illustrate how financial leverage affects net income and shareholders' return on equity (ROE).

EXAMPLE 1: Beta Company financed with 100% equity

Assume that the Beta Company has \$500,000 in assets that are financed with 100% equity. Fixed costs are \$120,000. Beta is expected to sell 100,000 units, resulting in operating income of [100,000 (\$4 - \$2)] - \$120,000 = \$80,000. Beta's tax rate is 40%. Calculate Beta's net income and return on equity if its EBIT increases or decreases by 10%.

Answer:

Beta's Return on Equity With 100% Equity Financing

	EBIT Less 10%	Expected EBIT	EBIT Plus 10%
EBIT	\$72,000	\$80,000	\$88,000
Interest expense	<u>0</u>	<u>0</u>	<u>0</u>
Income before taxes	\$72,000	\$80,000	\$88,000
Taxes at 40%	<u>28,800</u>	<u>32,000</u>	<u>35,200</u>
Net income	\$43,200	\$48,000	\$52,800
Shareholders' equity	\$500,000	\$500,000	\$500,000
Return on equity (ROE)	8.64%	9.60%	10.56%

EXAMPLE 2: Beta Company financed with 50% equity and 50% debt

Continuing the previous example, assume that Beta Company is financed with 50% equity and 50% debt. The interest rate on the debt is 6%. Calculate Beta's net income and return on equity if its EBIT increases or decreases by 10%. Beta's tax rate is 40%.

Answer:

Beta's Return on Equity with 50% Equity Financing

	EBIT Less 10%	Expected EBIT	EBIT Plus 10%
EBIT	\$72,000	\$80,000	\$88,000
Interest expense at 6%	<u>15,000</u>	<u>15,000</u>	<u>15,000</u>
Income before taxes	\$57,000	\$65,000	\$73,000
Taxes at 40%	<u>22,800</u>	<u>26,000</u>	<u>29,200</u>
Net income	\$34,200	\$39,000	\$43,800
Shareholders' equity	\$250,000	\$250,000	\$250,000
Return on equity (ROE)	13.68%	15.60%	17.52%

The interest expense associated with using debt represents a fixed cost that reduces net income. However, the lower net income value is spread over a smaller base of shareholders' equity, serving to magnify the ROE. In all three of the scenarios shown in the two examples, ROE is higher using leverage than it is without leverage.

Further analyzing the differences between the examples, we can see that the use of financial leverage not only increases the *level* of ROE, it also increases the *rate of change* for ROE. In the unleveraged scenario, ROE varies directly with the change in EBIT. For an increase in EBIT of 10%, the ROE increases from 9.60% to 10.56%, for a rate of change of 10%. In the leveraged scenario, ROE is more volatile. For an increase in EBIT of 10%, the ROE increases from 15.60% to 17.52%, for a rate of change of 12.3%.

The use of financial leverage increases the risk of default but also increases the potential return for equity holders.



PROFESSOR'S NOTE

Recall how this relationship is reflected in the DuPont formula used to analyze ROE. One of the components of the DuPont formula is the equity multiplier (assets/equity), which captures the effect of financial leverage on ROE.

LOS 34.d: Calculate the breakeven quantity of sales and determine the company's net income at various sales levels.

LOS 34.e: Calculate and interpret the operating breakeven quantity of sales.

The level of sales that a firm must generate to cover all of its fixed and variable costs is called the breakeven quantity. The **breakeven quantity of sales** is the quantity of sales for which revenues equal total costs, so that net income is zero. We can calculate the breakeven quantity by simply determining how many units must be sold to just cover total fixed costs.

For each unit sold, the **contribution margin**, which is the difference between price and variable cost per unit, is available to help cover fixed costs. We can thus describe the breakeven quantity of sales, Q_{BE} , as:

$$Q_{BE} = \frac{\text{fixed operating costs} + \text{fixed financing costs}}{\text{price} - \text{variable cost per unit}}$$

EXAMPLE: Breakeven quantity of sales

Consider the prices and costs for Atom Company and Beta Company shown in the following table. Compute and illustrate the breakeven quantity of sales for each company.

Operating Costs for Atom Company and Beta Company

	Atom Company	Beta Company
Price	\$4.00	\$4.00
Variable costs	\$3.00	\$2.00
Fixed operating costs	\$10,000	\$80,000
Fixed financing costs	\$30,000	\$40,000

Answer:

For Atom Company, the breakeven quantity is:

$$Q_{BE} (\text{Atom}) = \frac{\$10,000 + \$30,000}{\$4.00 - \$3.00} = 40,000 \text{ units}$$

Similarly, for Beta Company, the breakeven quantity is:

$$Q_{BE} (\text{Beta}) = \frac{\$80,000 + \$40,000}{\$4.00 - \$2.00} = 60,000 \text{ units}$$

The breakeven quantity and the relationship between sales revenue, total costs, net income, and net loss are illustrated in [Figure 34.1](#) and [Figure 34.2](#).

Figure 34.1: Breakeven Analysis for Atom Company

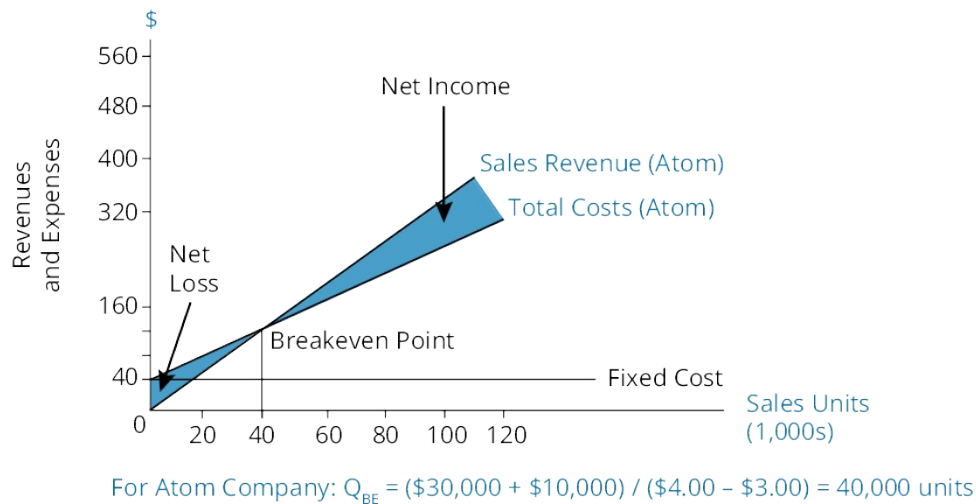
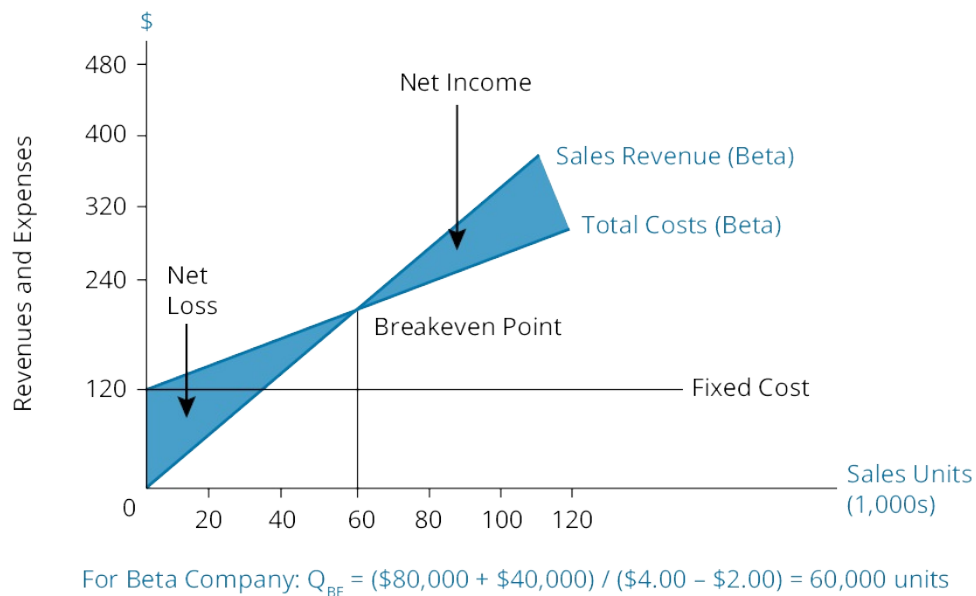


Figure 34.2: Breakeven Analysis for Beta Company



We can also calculate an **operating breakeven quantity of sales**. In this case, we consider only fixed operating costs and ignore fixed financing costs. The calculation is simply:

$$Q_{OBE} = \frac{\text{fixed operating costs}}{\text{price} - \text{variable cost per unit}}$$

EXAMPLE: Operating breakeven quantity of sales

Calculate the operating breakeven quantity of sales for Atom and Beta, using the same data from the previous example.

Answer:

For Atom, the operating breakeven quantity of sales is:

$$\$10,000 / (\$4.00 - \$3.00) = 10,000 \text{ units}$$

For Beta, the operating breakeven quantity of sales is:

$$\$80,000 / (\$4.00 - \$2.00) = 40,000 \text{ units}$$

We can summarize the effects of leverage on net income through an examination of [Figure 34.1](#) and [Figure 34.2](#). Other things equal, a firm that chooses operating and financial structures that result in greater total fixed costs will have a higher breakeven quantity of sales. Leverage of either type magnifies the effects of changes in sales on net income. The further a firm's sales are from its breakeven level of sales, the greater the magnifying effects of leverage on net income.

These same conclusions apply to operating leverage and the operating breakeven quantity of sales. One company may choose a larger scale of operations (larger factory), resulting in a greater operating breakeven quantity of sales and greater leverage, other things equal.

Note that the degree of total leverage is calculated for a particular level of sales. The slope of the net income line in [Figure 34.1](#) and [Figure 34.2](#) is related to total leverage but is not the same thing. The degree of total leverage is different for every level of sales.



MODULE QUIZ 34.1

To best evaluate your performance, enter your quiz answers online.

1. Business risk is the combination of:
 - A. operating risk and financial risk.
 - B. sales risk and financial risk.
 - C. operating risk and sales risk.
2. Which of the following is a key determinant of operating leverage?
 - A. Level and cost of debt.
 - B. The competitive nature of the business.
 - C. The trade-off between fixed and variable costs.
3. Which of the following statements about capital structure and leverage is *most accurate*?
 - A. Financial leverage is directly related to operating leverage.
 - B. Increasing the corporate tax rate will not affect capital structure decisions.
 - C. A firm with low operating leverage has a small proportion of its total costs in fixed costs.
4. Jayco, Inc., sells blue ink for \$4 a bottle. The ink's variable cost per bottle is \$2. Ink has fixed operating costs of \$4,000 and fixed financing costs of \$6,000. What is Jayco's breakeven quantity of sales, in units?
 - A. 2,000.
 - B. 3,000.
 - C. 5,000.
5. Jayco, Inc., sells blue ink for \$4 a bottle. The ink's variable cost per bottle is \$2. Ink has fixed operating costs of \$4,000 and fixed financing costs of \$6,000. What is Jayco's operating breakeven quantity of sales, in units?
 - A. 2,000.
 - B. 3,000.
 - C. 5,000.
6. If Jayco's sales increase by 10%, Jayco's EBIT increases by 15%. If Jayco's EBIT increases by 10%, Jayco's EPS increases by 12%. Jayco's degree of operating leverage (DOL) and degree of total leverage (DTL) are *closest* to:
 - A. 1.2 DOL and 1.5 DTL.
 - B. 1.2 DOL and 2.7 DTL.
 - C. 1.5 DOL and 1.8 DTL.

Use the following data to answer Questions 7 and 8.

Jayco, Inc., sells 10,000 units at a price of \$5 per unit. Jayco's fixed costs are \$8,000, interest expense is \$2,000, variable costs are \$3 per unit, and EBIT is \$12,000.

7. Jayco's degree of operating leverage (DOL) and degree of financial leverage (DFL) are *closest* to:
- A. 2.50 DOL and 1.00 DFL.
 - B. 1.67 DOL and 2.00 DFL.
 - C. 1.67 DOL and 1.20 DFL.
8. Jayco's degree of total leverage (DTL) is *closest* to:
- A. 2.00.
 - B. 1.75.
 - C. 1.50.
9. Vischer Concrete has \$1.2 million in assets that are currently financed with 100% equity. Vischer's EBIT is \$300,000, and its tax rate is 30%. If Vischer changes its capital structure (recapitalizes) to include 40% debt, what is Vischer's ROE before and after the change? Assume that the interest rate on debt is 5%.

<u>ROE at 100% equity</u>	<u>ROE at 60% equity</u>
A. 17.5%	26.8%
B. 25.0%	26.8%
C. 25.0%	37.5%

KEY CONCEPTS

LOS 34.a

Leverage increases the risk and potential return of a firm's earnings and cash flows.

Operating leverage increases with fixed operating costs.

Financial leverage increases with fixed financing costs.

Sales risk is uncertainty about the firm's sales.

Business risk refers to the uncertainty about operating earnings (EBIT) and results from variability in sales and expenses. Business risk is magnified by operating leverage.

Financial risk refers to the additional variability of EPS compared to EBIT. Financial risk increases with greater use of fixed cost financing (debt) in a company's capital structure.

LOS 34.b

The degree of operating leverage (DOL) is calculated as $\frac{Q(P - V)}{Q(P - V) - F}$ and is interpreted as $\frac{\% \Delta \text{EBIT}}{\% \Delta \text{sales}}$.

The degree of financial leverage (DFL) is calculated as $\frac{\text{EBIT}}{\text{EBIT} - I}$ and is interpreted as $\frac{\% \Delta \text{EPS}}{\% \Delta \text{EBIT}}$.

The degree of total leverage (DTL) is the combination of operating and financial leverage and is calculated as $\text{DOL} \times \text{DFL}$ and interpreted as $\frac{\% \Delta \text{EPS}}{\% \Delta \text{sales}}$.

LOS 34.c

Using more debt and less equity in a firm's capital structure reduces net income through added interest expense but also reduces net equity. The net effect can be to either increase or decrease ROE.

LOS 34.d

The breakeven quantity of sales is the amount of sales necessary to produce a net income of zero (total revenue just covers total costs) and can be calculated as:

$$\frac{\text{fixed operating costs} + \text{fixed financing costs}}{\text{price} - \text{variable cost per unit}}$$

Net income at various sales levels can be calculated as total revenue (i.e., price \times quantity sold) minus total costs (i.e., total fixed costs plus total variable costs).

LOS 34.e

The operating breakeven quantity of sales is the amount of sales necessary to produce an operating income of zero (total revenue just covers total operating costs) and can be calculated as:

$$\frac{\text{fixed operating costs}}{\text{price} - \text{variable cost per unit}}$$

ANSWER KEY FOR MODULE QUIZ

Module Quiz 34.1

1. **C** Business risk refers to the risk associated with a firm's operating income and is the result of uncertainty about a firm's revenues and the expenditures necessary to produce those revenues. Business risk is the combination of sales risk (the uncertainty associated with the price and quantity of goods and services sold) and operating risk (the leverage created by the use of fixed costs in the firm's operations). (LOS 34.a)
2. **C** The extent to which costs are fixed determines operating leverage. (LOS 34.b)
3. **C** If fixed costs are a small percentage of total costs, operating leverage is low. Operating leverage is separate from financial leverage, which depends on the amount of debt in the capital structure. Increasing the tax rate would make the after-tax cost of debt cheaper. (LOS 34.b)
4. **C** $Q_{BE} = \frac{\$4,000 + \$6,000}{\$4.00 - \$2.00} = 5,000 \text{ units (LOS 34.d)}$
5. **A** $Q_{OBE} = \frac{\$4,000}{\$4.00 - \$2.00} = 2,000 \text{ units (LOS 34.e)}$
6. **C** $DOL = \frac{15\%}{10\%} = 1.5$
 $DOL = \frac{12\%}{10\%} = 1.2$
 $DTL = DOL \times DFL = 1.5 \times 1.2 = 1.8$
 (LOS 34.b)
7. **C** $DOL = \frac{Q(P-V)}{[Q(P-V)-F]} = \frac{10,000(5-3)}{[10,000(5-3)-8,000]} = 1.67$
 $DFL = \frac{EBIT}{EBIT-I} = \frac{12,000}{12,000-2,000} = 1.2$
 (LOS 34.b)
8. **A** $DTL = \frac{Q(P-V)}{[Q(P-V)-F-I]} = \frac{10,000(5-3)}{[10,000(5-3)-8,000-2,000]} = 2$, or because we calculated the components in Question 7, $DTL = DOL \times DFL = 1.67 \times 1.2 = 2.0$ (LOS 34.b)
9. **A** With 100% equity:

EBIT	\$300,000
Interest expense	0
Income before taxes	\$300,000
Taxes at 30%	90,000
Net income	\$210,000
Shareholders' equity	\$1,200,000
ROE = NI/equity	17.5%

With 60% equity:

EBIT	\$300,000
Interest expense (\$480,000 at 5%)	24,000

Income before taxes	\$276,000
Taxes at 30%	82,800
Net income	\$193,200
Shareholders' equity	\$720,000
ROE = NI/equity	26.8%

(LOS 34.c)

The following is a review of the Corporate Finance (2) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #35.

READING 35: WORKING CAPITAL MANAGEMENT

Study Session 11

EXAM FOCUS

Firm liquidity is an important concern for an analyst, including how a firm manages its working capital, its short-term financing policy, and its sources of short-term financing for liquidity needs. A good portion of this topic review repeats material on ratios and yield calculations from previous topic areas and introduces types of debt securities that will also be covered in the topic reviews for fixed income investments.

New concepts introduced here are the management of current assets and liabilities, types of short-term bank financing, and the receivables aging schedule. Understand well why the management of inventory, receivables, and payables is important to a firm's overall profitability and value. The general guidelines for establishing and evaluating a firm's short-term investment policies and for evaluating short-term funding strategy and policy should be sufficient here. Focus on the overall objectives and how they can be met.

MODULE 35.1: WORKING CAPITAL MANAGEMENT



Video covering this content is available online.

LOS 35.a: Describe primary and secondary sources of liquidity and factors that influence a company's liquidity position.

CFA® Program Curriculum, Volume 4, page 157

A company's **primary sources of liquidity** are the sources of cash it uses in its normal day-to-day operations. The company's *cash balances* result from selling goods and services, collecting receivables, and generating cash from other sources such as short-term investments. Typical sources of *short-term funding* include trade credit from vendors and lines of credit from banks. Effective *cash flow management* of a firm's collections and payments can also be a source of liquidity for a company.

Secondary sources of liquidity include liquidating short-term or long-lived assets, negotiating debt agreements (i.e., renegotiating), or filing for bankruptcy and reorganizing the company. While using its primary sources of liquidity is unlikely to change the company's normal operations, resorting to secondary sources of liquidity such as these can change the company's financial structure and operations significantly and may indicate that its financial position is deteriorating.

Factors That Influence a Company's Liquidity Position

In general, a company's liquidity position improves if it can get cash to flow in more quickly and flow out more slowly. Factors that weaken a company's liquidity position are called *drags and pulls* on liquidity.

Drags on liquidity delay or reduce cash inflows, or increase borrowing costs. Examples include uncollected receivables and bad debts, obsolete inventory (takes longer to sell and can require sharp price discounts), and tight short-term credit due to economic conditions.

Pulls on liquidity accelerate cash outflows. Examples include paying vendors sooner than is optimal and changes in credit terms that require repayment of outstanding balances.

LOS 35.b: Compare a company's liquidity measures with those of peer companies.

CFA® Program Curriculum, Volume 4, page 159

Some companies tend to have chronically weak liquidity positions, often due to specific factors that affect the company or its industry. These companies typically need to borrow against their long-lived assets to acquire working capital.

Liquidity ratios are employed by analysts to determine the firm's ability to pay its short-term liabilities.

- The *current ratio* is the best-known measure of liquidity:

$$\text{current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

The higher the current ratio, the more likely it is that the company will be able to pay its short-term bills. A current ratio of less than one means that the company has negative working capital and is probably facing a liquidity crisis. Working capital equals current assets minus current liabilities.

- The *quick ratio* or *acid-test ratio* is a more stringent measure of liquidity because it does not include inventories and other assets that might not be very liquid:

$$\text{quick ratio} = \frac{\text{cash} + \text{short-term marketable securities} + \text{receivables}}{\text{current liabilities}}$$

The higher the quick ratio, the more likely it is that the company will be able to pay its short-term bills.

The current and quick ratios differ only in the assumed liquidity of the current assets that the analyst projects will be used to pay off current liabilities.

- A measure of accounts receivable liquidity is the *receivables turnover*:

$$\text{receivables turnover} = \frac{\text{credit sales}}{\text{average receivables}}$$

It is considered desirable to have a receivables turnover figure close to the industry norm.



PROFESSOR'S NOTE

This formula for the receivables turnover ratio uses credit sales in the numerator, rather than total sales as shown in the earlier topic review on ratio analysis. While an analyst within a company will know what proportion of sales are credit or cash sales, an external analyst will likely not have this information but may be able to estimate it based on standard industry practice.

In most cases when a ratio compares a balance sheet account (such as receivables) with an income or cash flow item (such as sales), the balance sheet item will be the average of the account instead of simply the end-of-year balance. Averages are calculated by adding the beginning-of-year account value and the end-of-year account value, then dividing the sum by two.

- The inverse of the receivables turnover multiplied by 365 is the *number of days of receivables* (also called *average days' sales outstanding*), which is the average number of days it takes for the company's customers to pay their bills:

$$\text{number of days of receivables} = \frac{365}{\text{receivables turnover}} = \frac{\text{average receivables}}{\text{average day's credit sales}}$$

It is considered desirable to have a collection period (and receivables turnover) close to the industry norm. The firm's credit terms are another important benchmark used to interpret this ratio. A collection period that is too high might mean that customers are too slow in paying their bills, which means too much capital is tied up in assets. A collection period that is too low might indicate that the firm's credit policy is too rigorous, which might be hampering sales.

- A measure of a firm's efficiency with respect to its processing and inventory management is the *inventory turnover*:

$$\text{inventory turnover} = \frac{\text{cost of goods sold}}{\text{average inventory}}$$



PROFESSOR'S NOTE

Pay careful attention to the numerator in the turnover ratios. For inventory turnover, be sure to use cost of goods sold, not sales.

- The inverse of the inventory turnover multiplied by 365 is the *average inventory processing period* or *number of days of inventory*:

$$\text{number of days of inventory} = \frac{365}{\text{inventory turnover}} = \frac{\text{average inventory}}{\text{average day's COGS}}$$

As is the case with accounts receivable, it is considered desirable to have an inventory processing period (and inventory turnover) close to the industry norm. A processing period that is too high might mean that too much capital is tied up in inventory and could mean that the inventory is obsolete. A processing period that is too low might indicate that the firm has inadequate stock on hand, which could hurt sales.

- A measure of the use of trade credit by the firm is the *payables turnover ratio*:

$$\text{payables turnover ratio} = \frac{\text{purchases}}{\text{average trade payables}}$$

- The inverse of the payables turnover ratio multiplied by 365 is the *payables payment period* or *number of days of payables*, which is the average amount of time it takes the company to pay its bills:

$$\text{number of days of payables} = \frac{365}{\text{payables turnover ratio}} = \frac{\text{average payables}}{\text{average day's purchases}}$$

LOS 35.c: Evaluate working capital effectiveness of a company based on its operating and cash conversion cycles and compare the company's effectiveness with that of peer companies.

CFA® Program Curriculum, Volume 4, page 159

- The **operating cycle**, the average number of days that it takes to turn raw materials into cash proceeds from sales, is:

$$\text{operating cycle} = \text{days of inventory} + \text{days of receivables}$$

- The *cash conversion cycle* or *net operating cycle* is the length of time it takes to turn the firm's cash investment in inventory back into cash, in the form of collections from

the sales of that inventory. The cash conversion cycle is computed from the average receivables collection period, average inventory processing period, and the payables payment period:

$$\text{cash conversion cycle} = (\text{average days of receivables}) + (\text{average days of inventory}) - (\text{average days of payables})$$

High cash conversion cycles are considered undesirable. A conversion cycle that is too high implies that the company has an excessive amount of investment in working capital.

LOS 35.d: Describe how different types of cash flows affect a company's net daily cash position.

CFA® Program Curriculum, Volume 4, page 164

Daily cash position refers to uninvested cash balances a firm has available to make routine purchases and pay expenses as they come due. The purpose of managing a firm's daily cash position is to have sufficient cash on hand (that is, make sure the firm's net daily cash position never becomes negative) but to avoid keeping excess cash because of the interest income foregone by not investing the cash.

Typical cash inflows for a firm include its cash from sales and collections of receivables; cash received from subsidiaries; dividends, interest, and principal received from investments in securities; tax refunds; and borrowing. Typical cash outflows include payments to employees and vendors; cash transferred to subsidiaries; payments of interest and principal on debt; investments in securities; taxes paid; and dividends paid.

To manage its cash position effectively, a firm should analyze its typical cash inflows and outflows by category and prepare forecasts over short-term (daily or weekly balances for the next several weeks), medium-term (monthly balances for the next year), and long-term time horizons. A firm can use these forecasts to identify periods when its cash balance may become low enough to require short-term borrowing, or high enough to invest excess cash in short-term securities.

LOS 35.e: Calculate and interpret comparable yields on various securities, compare portfolio returns against a standard benchmark, and evaluate a company's short-term investment policy guidelines.

CFA® Program Curriculum, Volume 4, page 169

Short-term securities in which a firm can invest cash include:

- U.S. Treasury bills.
- Short-term federal agency securities.
- Bank certificates of deposit.
- Banker's acceptances.
- Time deposits.
- Repurchase agreements.
- Commercial paper.
- Money market mutual funds.

- Adjustable-rate preferred stock.

Adjustable-rate preferred stock has a dividend rate that is reset quarterly to current market yields and offers corporate holders a tax advantage because a percentage of the dividends received are exempt from federal tax. The other securities listed are all described in more detail in the topic reviews on fixed-income securities.

Yield Calculations for Short-Term Discount Securities

The percentage discount from face value is:

$$\% \text{ discount} = \left(\frac{\text{face value} - \text{price}}{\text{face value}} \right)$$

The discount-basis yield (bank discount yield or BDY) is:

$$\text{discount-basis yield} = \left(\frac{\text{face value} - \text{price}}{\text{face value}} \right) \left(\frac{360}{\text{days}} \right) = \% \text{ discount} \times \left(\frac{360}{\text{days}} \right)$$

The money market yield is:

$$\begin{aligned} \text{money market yield} &= \left(\frac{\text{face value} - \text{price}}{\text{price}} \right) \left(\frac{360}{\text{days}} \right) \\ &= \text{holding period yield} \times \left(\frac{360}{\text{days}} \right) \end{aligned}$$

where:

“days” = days to maturity

“price” = purchase price of the security

The bond equivalent yield measure for short-term discount securities is calculated as:

$$\begin{aligned} \text{bond equivalent yield} &= \left(\frac{\text{face value} - \text{price}}{\text{price}} \right) \left(\frac{365}{\text{days to maturity}} \right) \\ &= \text{holding period yield} \times \left(\frac{365}{\text{days}} \right) \end{aligned}$$

Returns on the firm’s short-term securities investments should be stated as bond equivalent yields. The return on the portfolio should be expressed as a weighted average of these yields.

Cash Management Investment Policy

Typically, the objective of cash management is to earn a market return without taking on much risk, either liquidity risk or default risk. Firms invest cash that may be needed in the short term in securities of relatively high credit quality and relatively short maturities to minimize these risks.

It is advisable to have a written investment policy statement. An investment policy statement typically begins with a statement of the purpose and objective of the investment portfolio, some general guidelines about the strategy to be employed to achieve those objectives, and the types of securities that will be used. The investment policy statement will also include specific information on who is allowed to purchase securities, who is responsible for complying with company guidelines, and what steps will be taken if the investment guidelines are not followed. Finally, the investment policy statement will include limitations

on the specific types of securities permitted for investment of short-term funds, limitations on the credit ratings of portfolio securities, and limitations on the proportions of the total short-term securities portfolio that can be invested in the various types of permitted securities.

An investment policy statement should be evaluated on how well the policy can be expected to satisfy the goals and purpose of short-term investments, generating yield without taking on excessive credit or liquidity risk. The policy should not be overly restrictive in the context of meeting the goals of safety and liquidity.

LOS 35.f: Evaluate a company's management of accounts receivable, inventory, and accounts payable over time and compared to peer companies.

CFA® Program Curriculum, Volume 4, page 175

Accounts Receivable Management

The management of accounts receivable begins with calculating the average days of receivables and comparing this ratio to the firm's historical performance or to the average ratios for a group of comparable companies. More detail about the accounts receivable performance can be gained by using an **aging schedule** such as that presented in [Figure 35.1](#).

Figure 35.1: Receivables Aging (thousands of dollars)

Days Outstanding	March	April	May
< 31 days	200	212	195
31–60 days	150	165	140
61–90 days	100	90	92
> 90 days	50	70	66

In March, \$200,000 of accounts receivable were current—that is, had been outstanding less than 31 days; \$50,000 of the receivables at the end of March had been outstanding for more than 90 days.

Presenting this data as percentages of total outstanding receivables can facilitate analysis of how the aging schedule for receivables is changing over time. An example is presented in [Figure 35.2](#).

Figure 35.2: Receivables Aging (% of totals)

Days Outstanding	March	April	May
< 31 days	40%	39%	40%
31–60 days	30%	31%	28%
61–90 days	20%	17%	19%

> 90 days	10%	13%	13%
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Another useful metric for monitoring the accounts receivable performance is the *weighted average collection period*, which indicates the average days outstanding per dollar of receivables. As illustrated in [Figure 35.3](#), the weights are the percentage of total receivables in each category, and these are multiplied by the average days to collect accounts within each aging category.

Figure 35.3: Weighted Average Collection Period—March

Days Outstanding	Average Collection Days	% Weight	Days × Weight
< 31 days	22	40%	8.8
31–60 days	44	30%	13.2
61–90 days	74	20%	14.8
> 90 days	135	10%	13.5
Weighted Average Collection Period			50.3 days

The information necessary to compare a firm’s aging schedule and weighted average collection period to other firms is not available. However, analysis of the historical trends and significant changes in a firm’s aging schedule and weighted average collection days can give a clearer picture of what is driving changes in the simpler metric of average days of receivables. The company must always evaluate the trade-off between stricter credit terms (and borrower creditworthiness) and the ability to make sales. Terms that are too strict will lead to less-than-optimal sales. Terms that are too lenient will increase sales at the cost of longer average days of receivables, which must be funded at some cost, and will increase bad accounts, directly affecting profitability.

Inventory Management

Inventory management involves a trade-off as well. Inventory levels that are too low will result in lost sales due to stock-outs, while inventory that is too large will have carrying costs because the firm’s capital is tied up in inventory. Reducing inventory will free up cash that can be invested in interest-bearing securities or used to reduce debt or equity funding. Increasing average days’ inventory or a decreasing inventory turnover ratio can both indicate that inventory is too large. A large inventory can lead to greater losses from obsolete items and can also indicate that obsolete items that no longer sell well are included in inventory.

Comparing average days of inventory and inventory turnover ratios between industries, or even between two firms that have different business strategies, can be misleading. The grocery business typically has high inventory turnover, while an art gallery’s inventory turnover will typically be low. An auto parts firm that stocks hard-to-find parts for antique cars will likely have a low inventory turnover (and charge premium prices) compared to a chain auto parts store that does most of its business in standard items like oil filters, brake

parts, and antifreeze. In any business, inventory management is an important component of effective overall financial management.

Accounts Payable Management

Just as a company must manage its receivables because they require working capital (and therefore have a funding cost), payables must be managed well because they represent a source of working capital to the firm. If the firm pays its payables prior to their due dates, cash is used unnecessarily and interest on it is sacrificed. If a firm pays its payables late, it can damage relationships with suppliers and lead to more restrictive credit terms or even the requirement that purchases be made for cash. Late payment can also result in interest charges that are high compared to other sources of short-term financing.

Typical terms on payables (trade credit) contain a discount available to those who pay quickly as well as a due date. Terms of “2/10 net 60” mean that if the invoice is paid within 10 days, the company gets a 2% discount on the invoiced amount and that if the company does not take advantage of the discount, the net amount is due 60 days from the date of the invoice.

The cost to the company of not taking the discount for early payment can be evaluated as an annualized rate:

$$\text{cost of trade credit} = \left(1 + \frac{\% \text{ discount}}{1 - \% \text{ discount}} \right)^{\frac{365}{\text{days past discount}}} - 1$$

where:

days past discount = number of days after the end of the discount period

Trade credit can be a source of liquidity for a company. However, when the cost of trade credit is greater than the company's cost of short-term liquidity from other sources, the company is better off paying the invoice within (ideally at the end of) the discount period.

EXAMPLE: Cost of trade credit

Calculate and interpret the annualized cost of trade credit for invoice terms of 2/10 net 60, when the invoice is paid on the 40th, 50th, or 60th day.

Answer:

The discount is 2%. The annualized cost of not taking the discount can be calculated when the invoice is paid on:

$$\text{Day 40: } \left(1 + \frac{0.02}{1 - 0.02} \right)^{\frac{365}{40 - 10}} - 1 = 27.9\%$$

$$\text{Day 50: } \left(1 + \frac{0.02}{1 - 0.02} \right)^{\frac{365}{50 - 10}} - 1 = 20.2\%$$

$$\text{Day 60: } \left(1 + \frac{0.02}{1 - 0.02} \right)^{\frac{365}{60 - 10}} - 1 = 15.9\%$$

The annualized cost of trade credit decreases as the payment period increases. If the company does not take the 2% discount within the first ten days, it should wait until the due date (day 60) to pay the invoice.

Our primary quantitative measure of payables management is average days of payables outstanding, which can also be calculated as:

$$\text{number of days of payables} = \frac{\text{accounts payable}}{\text{average day's purchases}}$$

where:

$$\text{average day's purchases} = \frac{\text{annual purchases}}{365}$$

A company with a short payables period (high payables turnover) may simply be taking advantage of discounts for paying early because it has good low-cost funds available to finance its working capital needs. A company with a long payables period may be such an important buyer that it can effectively utilize accounts payable as a source of short-term funding with relatively little cost (because suppliers will put up with it). Monitoring the changes in days' payables outstanding over time for a single firm will, however, aid the analyst. An extension of days' payables may serve as an early warning of deteriorating short-term liquidity.

LOS 35.g: Evaluate the choices of short-term funding available to a company and recommend a financing method.

CFA® Program Curriculum, Volume 4, page 189

There are several sources of short-term funding available to a company, from both bank and non-bank sources. We list the most important of these here.

Sources of Short-Term Funding From Banks

Lines of credit are used primarily by large, financially sound companies.

- *Uncommitted line of credit.* A bank extends an offer of credit for a certain amount but may refuse to lend if circumstances change.
- *Committed (regular) line of credit.* A bank extends an offer of credit that it “commits to” for some period of time. The fact that the bank has committed to extend credit in amounts up to the credit line makes this a more reliable source of short-term funding than an uncommitted line of credit. Banks charge a fee for making such a commitment. Loans under the agreement are typically for periods of less than a year, and interest charges are stated in terms of a short-term reference rate, such as LIBOR or the U.S. prime rate, plus a margin to compensate for the credit risk of the loan. Outside the United States, similar arrangements are referred to as *overdraft lines of credit*.
- *Revolving line of credit.* An even more reliable source of short-term financing than a committed line of credit, revolving lines of credit are typically for longer terms, sometimes as long as years. Along with committed lines of credit, revolving credit lines can be verified and can be listed on a firm's financial statements in the footnotes as a source of liquidity.

Companies with weaker credit may have to pledge assets as collateral for bank borrowings. Fixed assets, inventory, and accounts receivable may all serve as collateral for loans. Short-term financing is typically collateralized by receivables or inventory and longer-term loans are secured with a claim to fixed (longer-term) assets. The bank may also have a *blanket lien* which gives it a claim to all current and future firm assets as collateral in case the primary collateral is insufficient and the borrowing firm defaults. When a firm assigns its receivables

to the bank making a loan, the company still services the receivables and remains responsible for any receivables that are not paid.

Banker's acceptances are used by firms that export goods. A banker's acceptance is a guarantee from the bank of the firm that has ordered the goods stating that a payment will be made upon receipt of the goods. The exporting company can then sell this acceptance at a discount in order to generate immediate funds.

Factoring refers to the actual sale of receivables at a discount from their face values. The size of the discount will depend on how long it is until the receivables are due, the creditworthiness of the firm's credit customers, and the firm's collection history on its receivables. The "factor" (the buyer of the receivables) takes on the responsibility for collecting receivables and the credit risk of the receivables portfolio.

Non-Bank Sources of Short-Term Funding

Smaller firms and firms with poor credit may use nonbank *finance companies* for short-term funding. The cost of such funding is higher than other sources and is used by firms for which normal bank sources of short-term funding are not available.

Large, creditworthy companies can issue short-term debt securities called **commercial paper**. Whether the firm sells the paper directly to investors (direct placement) or sells it through dealers (dealer-placed paper), the interest costs are typically slightly less than the rate they could get from a bank.

In managing its short-term financing, a firm should focus on the objectives of having sufficient sources of funding for current, as well as future foreseeable, cash needs and should seek the most cost-effective rates available given its needs, assets, and creditworthiness. The firm should have the ability to prepay short-term borrowings when cash flow permits and have the flexibility to structure its short-term financing so that the debt matures without peaks and can be matched to expected cash flows. For large borrowers, it is important that the firm has alternative sources of short-term funding and even alternative lenders for a particular type of financing. It is often worth having slightly higher overall short-term funding costs in order to have flexibility and redundant sources of financing.



MODULE QUIZ 35.1

To best evaluate your performance, enter your quiz answers online.

1. An example of a primary source of liquidity is:
 - A. liquidating assets.
 - B. negotiating debt contracts.
 - C. short-term investment portfolios.
2. Firm A and Firm B have the same quick ratio, but Firm A has a greater current ratio than Firm B. Compared to Firm B, it is *most likely* that Firm A has:
 - A. greater inventory.
 - B. greater payables.
 - C. a higher receivables turnover ratio.
3. An increase in Rowley Corp's cash conversion cycle and a decrease in Rowley's operating cycle could result from:

Cash conversion cycle increase Operating cycle decrease

- A. Decreased receivables turnover
- Increased payables turnover

Decrease in days of inventory

B. Decreased receivables turnover

C. Increased inventory turnover

Increased payables turnover

4. Which of the following statements *most accurately* describes a key aspect of managing a firm's net daily cash position?
- A. Analyze cash inflows and outflows to forecast future needs for cash.
 - B. Maximize the firm's cash inflows and minimize its cash outflows.
 - C. Minimize uninvested cash balances because they earn a return of zero.
5. Boyle, Inc., just purchased a banker's acceptance for \$25,400. It will mature in 80 days for \$26,500. The discount-basis yield and the bond equivalent yield for this security are *closest* to:

Discount-basis

Bond equivalent

A. 18.7%

18.7%

B. 18.7%

19.8%

C. 4.2%

19.8%

6. An aging schedule is *most likely* used by a company to evaluate its management of:
- A. inventories.
 - B. accounts payable.
 - C. accounts receivable.
7. Chapmin Corp. is a large domestic services firm with a good credit rating. The source of short-term financing it would *most likely* use is:
- A. factoring of receivables.
 - B. issuing commercial paper.
 - C. issuing bankers' acceptances.

KEY CONCEPTS

LOS 35.a

Primary sources of liquidity are the sources of cash a company uses in its normal operations. If its primary sources are inadequate, a company can use secondary sources of liquidity such as asset sales, debt renegotiation, and bankruptcy reorganization.

A company's liquidity position depends on the effectiveness of its cash flow management and is influenced by drags on its cash inflows (e.g., uncollected receivables, obsolete inventory) and pulls on its cash outflows (e.g., early payments to vendors, reductions in credit limits).

LOS 35.b

Measures of a company's short-term liquidity include:

- Current ratio = current assets / current liabilities.
- Quick ratio = (cash + marketable securities + receivables) / current liabilities.

Measures of how well a company is managing its working capital include:

- Receivables turnover = credit sales / average receivables.
- Number of days of receivables = 365 / receivables turnover.
- Inventory turnover = cost of goods sold / average inventory.
- Number of days of inventory = 365 / inventory turnover.
- Payables turnover = purchases / average trade payables.
- Number of days of payables = 365 / payables turnover.

LOS 35.c

The operating cycle and the cash conversion cycle are summary measures of the effectiveness of a company's working capital management.

- Operating cycle = days of inventory + days of receivables.
- Cash conversion cycle = days of inventory + days of receivables – days of payables.

Operating and cash conversion cycles that are high relative to a company's peers suggest the company has too much cash tied up in working capital.

LOS 35.d

To manage its net daily cash position, a firm needs to forecast its cash inflows and outflows and identify periods when its cash balance may be lower than needed or higher than desired. Cash inflows include operating receipts, cash from subsidiaries, cash received from securities investments, tax refunds, and borrowing. Cash outflows include purchases, payroll, cash transfers to subsidiaries, interest and principal paid on debt, investments in securities, taxes paid, and dividends paid.

LOS 35.e

Commonly used annualized yields for short-term pure discount securities are based on the days to maturity (days) of the securities and include:

- Discount-basis yields = % discount from face value \times (360 / days).

- Money market yields = $\text{HPY} \times (360 / \text{days})$.
- Bond-equivalent yields = $\text{HPY} \times (365 / \text{days})$.

The overall objective of short-term cash management is to earn a reasonable return while taking on only very limited credit and liquidity risk. Returns on the firm's short-term securities investments should be stated as bond equivalent yields. The return on the portfolio should be expressed as a weighted average of these yields.

An investment policy statement should include the objectives of the cash management program, details of who is authorized to purchase securities, authorization for the purchase of specific types of securities, limitations on portfolio proportions of each type, and procedures in the event that guidelines are violated.

LOS 35.f

A firm's inventory, receivables, and payables management can be evaluated by comparing days of inventory, days of receivables, and days of payables for the firm over time and by comparing them to industry averages or averages for a group of peer companies.

A receivables aging schedule and a schedule of weighted average days of receivables can each provide additional detail for evaluating receivables management.

LOS 35.g

There are many choices for short-term borrowing. The firm should keep costs down while also allowing for future flexibility and alternative sources.

The choice of short-term funding sources depends on a firm's size and creditworthiness. Sources available, in order of decreasing firm creditworthiness and increasing cost, include:

- Commercial paper.
- Bank lines of credit.
- Collateralized borrowing.
- Nonbank financing.
- Factoring.

ANSWER KEY FOR MODULE QUIZ

Module Quiz 35.1

1. **C** Primary sources of liquidity include ready cash balances, short-term funds (e.g., short-term investment portfolios), and cash flow management. Secondary sources of liquidity include negotiating debt contracts, liquidating assets, and filing for bankruptcy protection and reorganization. (LOS 35.a)
2. **A** Inventory is in the numerator of the current ratio but not in the quick ratio. Greater inventory for Firm A is consistent with a greater current ratio for Firm A. (LOS 35.b)
3. **B** A decrease in receivables turnover would increase days of receivables and increase the cash conversion cycle. A decrease in days of inventory would decrease the operating cycle. (LOS 35.c)
4. **A** The goal of managing the net daily cash position is to ensure that adequate cash is available to prevent the firm from having to arrange financing on short notice (and thus at high cost), while earning a return on cash balances when they are temporarily high by investing in short-term securities. A firm can meet this goal by forecasting its cash inflows and outflows to identify periods when its cash balance is expected to be lower or higher than needed. “Minimizing uninvested cash balances” is inaccurate because a firm should maintain some target amount of available cash. (LOS 35.d)
5. **B** The actual discount on the acceptance is $(26,500 - 25,400) / 26,500 = 4.151\%$. The annualized discount, or discount-basis yield, is $4.151(360 / 80) = 18.68\%$.
The holding period yield is $(26,500 - 25,400) / 25,400 = 4.331\%$. The bond equivalent yield is $4.331(365 / 80) = 19.76\%$. (LOS 35.e)
6. **C** Aging schedules are used to evaluate management of accounts receivable by classifying these accounts by the time they have been outstanding. (LOS 35.f)
7. **B** Large firms with good credit have access to the commercial paper market and can get lower financing costs with commercial paper than they can with bank borrowing. Bankers’ acceptances are used by companies involved in international trade. Factoring of receivables is a higher-cost source of funds and is used more by smaller firms that do not have particularly strong credit. (LOS 35.g)

TOPIC ASSESSMENT: CORPORATE FINANCE

You have now finished the Corporate Finance topic section. The following Topic Assessment provides immediate feedback on how effective your study has been for this material. The number of questions on this test is equal to the number of questions for the topic on one-half of the actual Level I CFA exam. Questions are more exam-like than typical Module Quiz or QBank questions; a score of less than 70% indicates that your study likely needs improvement. These tests are best taken timed; allow 1.5 minutes per question.

After you've completed this Topic Assessment, you may additionally log in to your [Schweser.com](https://www.schweser.com) online account and enter your answers in the Topic Assessments product. Select "Performance Tracker" to view a breakdown of your score. Select "Compare with Others" to display how your score on the Topic Assessment compares to the scores of others who entered their answers.

1. An analyst calculates the following leverage ratios for Burkhardt Company and Dutchin Company:

	Degree of Operating Leverage	Degree of Financial Leverage
Burkhardt	1.6	3.0
Dutchin	1.2	4.0

If both companies' sales increase by 5%, what are the *most likely* effects on the companies' earnings before interest and taxes (EBIT) and earnings per share (EPS)?

- A. Both companies' EBIT will increase by the same percentage.
 - B. Dutchin's EPS will increase by a larger percentage than Burkhardt's EPS.
 - C. Burkhardt's EBIT will increase by a larger percentage than Dutchin's EBIT.
2. Sutter Corp. is considering two mutually exclusive projects with the following after-tax cash flows:

TIME	0	1	2	3	4	5	6
Project 1	-10,000	2,000	2,000	2,000	4,000	4,000	4,000
Project 2	-12,000	2,000	2,000	2,000	5,000	5,000	5,000

Given that Sutter's cost of capital is 7.5%, the IRR of the project that Sutter should select is *closest to*:

- A. 13%.
 - B. 15%.
 - C. 17%.
3. Which of the following changes in a firm's working capital management is *most likely* to result in a shorter operating cycle?
 - A. Reducing stock-outs by carrying greater quantities of inventory.
 - B. Stretching its payables by paying on the last permitted date.

- C. Changing its credit terms for customers from 2/10, net 60 to 2/10, net 30.
4. A company's operations analyst is evaluating a plant expansion project that is likely to be financed in part by issuing new common equity. Flotation costs are expected to be 4% of the amount of new equity capital raised. The *most appropriate* way for the analyst to treat the flotation costs is to:
- A. ignore them, because flotation costs for common equity are likely to be nonmaterial.
 - B. estimate the cost of equity capital based on a share price 4% less than the current price.
 - C. determine the flotation cost attributable to this project and treat it as part of the project's initial cash outflow.
5. Executive directors are *least likely* to be included in:
- A. a supervisory board.
 - B. a one-tier board.
 - C. a management board.
6. The manufacturer of Pow Detergent has developed New Improved Pow with Dirteaters and is considering adding it to its product line. New Improved Pow would sell at a premium price compared to Pow. In order to manufacture New Improved Pow, the firm will need to build a new facility and purchase new equipment. Which of the following is *least likely* included when calculating the appropriate cash flows for analysis of whether to add New Improved Pow to its product line?
- A. Expected depreciation on the new facility and equipment for tax purposes.
 - B. Costs of a marketing survey performed last month to decide whether to introduce New Improved Pow.
 - C. Reduced sales of Pow that result from the introduction of New Improved Pow.
7. The use of secondary sources of liquidity would *most likely* be considered:
- A. a normal part of daily business for a company.
 - B. a signal that a company's financial position is deteriorating.
 - C. a lower-cost source of short-term financing compared to primary sources of liquidity.
8. Balfour Corp. is in the food distribution business and has a beta of 1.1, a marginal tax rate of 34%, and a debt-to-assets ratio of 40%. Balfour management is evaluating an entry into the fast-casual restaurant business. They have identified a publicly traded company in the fast-casual restaurant industry that has an equity beta of 1.3, a marginal tax rate of 28%, and a debt-to-equity ratio of 40%. The appropriate beta for Balfour to use in calculating the cost of equity capital for the analysis of the potential entry into the restaurant business is *closest to*:
- A. 1.15.
 - B. 1.30.
 - C. 1.45.
9. With regard to the internal rate of return (IRR), which of the following statements is *most accurate*?
- A. The IRR is the discount rate that maximizes a project's net present value.
 - B. A proper decision rule is to accept the project if IRR is less than the required rate of return.

C. IRR is the discount rate at which the present value of expected future after-tax cash flows is equal to the investment outlay.

10. In early 20X8, a company changed its customer credit terms from 2/10, net 30 to 2/10, net 40. Comparisons of accounts receivable aging schedules at the end of 20X7 and 20X8 follow.

Number of Days	20X7 \$ millions	20X8 \$ millions
0–30	380	350
31–60	65	140
61–90	41	35
Over 90	54	55
Total accounts receivable	540	580

The trends in the company's receivables indicate:

- A. improved collections on credit accounts.
 - B. slower payments from credit customers.
 - C. a higher receivables turnover ratio.
11. William Mason, CFA, is a project manager for the semiconductor division of Mammoth Industries, a conglomerate. The semiconductor division's projected cash flows are less certain than Mammoth's overall cash flows. When determining the net present values of projects within the semiconductor division, Mason should use:
- A. Mammoth Industries' marginal cost of capital.
 - B. a lower marginal cost of capital than Mammoth Industries.
 - C. a higher marginal cost of capital than Mammoth Industries.
12. Isaac Segovia, CFA, is using the net present value (NPV) and internal rate of return (IRR) methods to analyze a project for his firm. After its initial cash outflow, the project will generate several years of cash inflows, but will require a net cash outflow in the final year. The problem Segovia is *most likely* to encounter when using the NPV or IRR methods for this analysis is:
- A. multiple IRRs.
 - B. negative NPV.
 - C. conflicting NPV and IRR project rankings.

TOPIC ASSESSMENT ANSWERS: CORPORATE FINANCE

1. **C** The DOL is the percent change in operating income (EBIT) that will result from a 1% change in sales. Because Burkhardt has a higher DOL than Dutchin, Burkhardt's EBIT will increase by a larger percentage if both companies' sales increase by the same percentage. The percentage change in EPS resulting from a change in sales of 1% is measured by the degree of total leverage. The DTL for Burkhardt is $1.6 \times 3.0 = 4.8$, and the DTL for Dutchin is $1.2 \times 4.0 = 4.8$. If both companies' sales increase by the same percentage, their EPS will also increase by the same percentage. (Study Session 11, Module 34.1, LOS 34.b)
2. **B** Sutter should choose project 2 because it has a higher NPV. The NPV of project 1 is \$3,574 and its IRR is 16.79%. The NPV of project 2 is \$3,668 and its IRR is 15.18%. (Study Session 10, Modules 32.1, 32.2, LOS 32.c, 32.d)
3. **C** The operating cycle is average days of receivables plus average days of inventory. Changing its credit terms for customers from "net 60" to "net 30" would likely decrease the firm's average days of receivables and shorten its operating cycle. Increasing inventory quantities would increase average days of inventory and lengthen the operating cycle. Stretching payables by waiting until their due date to pay would increase the firm's average days of payables. This would shorten the firm's cash conversion cycle (days of receivables + days of inventory – days of payables) but would not affect its operating cycle. (Study Session 11, Module 35.1, LOS 35.c)
4. **C** The correct treatment of flotation costs is to treat them as a cash outflow at the project's initiation. Methods that adjust the cost of equity capital (and therefore the WACC) for flotation costs are incorrect because the cost of capital is an ongoing expense, whereas flotation costs are actually a one-time expense. Flotation costs for common equity are typically large enough that they must be considered in computing a project's NPV. (Study Session 10, Module 33.2, LOS 33.l)
5. **A** Executive directors are board members who are also senior managers of the company. In a two-tier board structure, the management board includes executive directors, and the supervisory board includes only external (non-executive) directors. (Study Session 10, Module 31.1, LOS 31.f)
6. **B** Costs that are incurred prior to the decision of whether or not to pursue a project are sunk costs and should not be used in the NPV calculation. Only cash flows that result from the decision to actually do the project should be considered in the analysis. Taxes must be deducted so the project's cash flows can be analyzed on an after-tax basis. Because depreciation is tax deductible, expected depreciation will affect annual taxes and after-tax cash flows. Cannibalization of sales of an existing product is an externality that should be included in the estimation of incremental project cash flows. (Study Session 10, Module 32.1, LOS 32.b)
7. **B** Secondary sources of liquidity include renegotiating debt contracts, liquidating assets, and filing for bankruptcy protection and reorganization. The use of these sources of funds is typically a signal that a company's financial position is deteriorating. The liquidity provided by these sources usually comes at a substantially

higher cost than liquidity provided by primary sources. (Study Session 11, Module 35.1, LOS 35.a)

8. **C** $\beta_{\text{asset}} = 1.3 \left(\frac{1}{1 + (1 - 0.28)(0.4)} \right) = 1.01$

Balfour's debt-to-assets ratio of 40% gives it a debt-to-equity ratio of

$$\frac{0.4}{1 - 0.4} = 0.67$$

$$\beta_{\text{project}} = 1.01[1 + (1 - 0.34)(0.67)] = 1.46$$

(Study Session 10, Module 33.2, LOS 33.i)

9. **C** The IRR is the discount rate that equates a project's initial cost with the present value of its future expected cash flows, (i.e., for which a project's net present value equals zero). The correct IRR decision rule is to accept the project if IRR is greater than the required rate of return, and to reject the project if IRR is less than the required rate of return. (Study Session 10, Module 32.1, LOS 32.d)
10. **B** The percentage of receivables outstanding for 31 to 60 days increased from 12% to 24%, while the percentage outstanding for 0 to 30 days decreased from 70% to 60%. Slower customer payments after the change in credit terms may indicate liquidity problems. (Study Session 11, Module 35.1, LOS 35.f)
11. **C** Mason should use a higher marginal cost of capital than Mammoth Industries to adjust for the semiconductor division's higher cash flow risk. (Study Session 10, Module 33.1, LOS 33.e)
12. **A** A project with an unconventional cash flow pattern (multiple sign changes) can have multiple IRRs or no IRR. Conflicting project rankings between the NPV and IRR methods can occur, but here the analyst is evaluating a single project. Not enough information is given to determine whether the NPV will be negative, but a single project with a negative NPV will simply be rejected. (Study Session 10, Module 32.2, LOS 32.e, 32.f)

The following is a review of the Equity Investments (1) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #36.

READING 36: MARKET ORGANIZATION AND STRUCTURE

Study Session 12

EXAM FOCUS

There is a great deal of introductory material in this review. Almost all of the types of securities discussed are covered in detail elsewhere in the curriculum. We introduce the terminology you will need but leave many of the details to the topic reviews specific to each security type. You should understand the concept of purchasing stock on margin and be able to calculate the return on an investment using margin. Be able to differentiate between market and limit orders as well as between quote-driven, order-driven, and brokered markets. Know that market regulation should increase informational, allocational, and operational market efficiency.

MODULE 36.1: MARKETS, ASSETS, AND INTERMEDIARIES



Video covering this content is available online.

LOS 36.a: Explain the main functions of the financial system.

CFA[®] Program Curriculum, Volume 4, page 208

The three main functions of the financial system are to:

1. Allow entities to save and borrow money, raise equity capital, manage risks, trade assets currently or in the future, and trade based on their estimates of asset values.
2. Determine the returns (i.e., interest rates) that equate the total supply of savings with the total demand for borrowing.
3. Allocate capital to its most efficient uses.

The financial system allows the transfer of assets and risks from one entity to another as well as across time. Entities who utilize the financial system include individuals, firms, governments, charities, and others.

Achievement of Purposes in the Financial System

The financial system allows entities to save, borrow, issue equity capital, manage risks, exchange assets, and to utilize information. The financial system is best at fulfilling these roles when the markets are liquid, transactions costs are low, information is readily available, and when regulation ensures the execution of contracts.

Savings. Individuals will save (e.g., for retirement) and expect a return that compensates them for risk and the use of their money. Firms save a portion of their sales to fund future

expenditures. Vehicles used for saving include stocks, bonds, certificates of deposit, real assets, and other assets.

Borrowing. Individuals may borrow in order to buy a house, fund a college education, or for other purposes. A firm may borrow in order to finance capital expenditures and for other activities. Governments may issue debt to fund their expenditures. Lenders can require collateral to protect them in the event of borrower defaults, take an equity position, or investigate the credit risk of the borrower.

Issuing equity. Another method of raising capital is to issue equity, where the capital providers will share in any future profits. Investment banks help with issuance, analysts value the equity, and regulators and accountants encourage the dissemination of information.

Risk management. Entities face risks from changing interest rates, currency values, commodities values, and defaults on debt, among other things. For example, a firm that owes a foreign currency in 90 days can lock in the price of this foreign currency in domestic currency units by entering into a forward contract. Future delivery of the foreign currency is guaranteed at a domestic-currency price set at inception of the contract. In this transaction, the firm would be referred to as a *hedger*. This hedging allows the firm to enter a market that it would otherwise be reluctant to enter by reducing the risk of the transaction. Hedging instruments are available from exchanges, investment banks, insurance firms, and other institutions.

Exchanging assets. The financial system also allows entities to exchange assets. For example, Procter and Gamble may sell soap in Europe but have costs denominated in U.S. dollars. Procter and Gamble can exchange their euros from soap sales for dollars in the currency markets.

Utilizing information. Investors with information expect to earn a return on that information in addition to their usual return. Investors who can identify assets that are currently undervalued or overvalued in the market can earn extra returns from investing based on their information (when their analysis is correct).

Return Determination

The financial system also provides a mechanism to determine the rate of return that equates the amount of borrowing with the amount of lending (saving) in an economy. Low rates of return increase borrowing but reduce saving (increase current consumption). High rates of return increase saving but reduce borrowing. The **equilibrium interest rate** is the rate at which the amount individuals, businesses, and governments desire to borrow is equal to the amount that individuals, businesses, and governments desire to lend. Equilibrium rates for different types of borrowing and lending will differ due to differences in risk, liquidity, and maturity.

Allocation of Capital

With limited availability of capital, one of the most important functions of a financial system is to allocate capital to its most efficient uses. Investors weigh the expected risks and returns of different investments to determine their most preferred investments. As long as investors are well informed regarding risk and return and markets function well, this results in an allocation to capital to its most valuable uses.

LOS 36.b: Describe classifications of assets and markets.

CFA® Program Curriculum, Volume 4, page 216

Financial assets include securities (stocks and bonds), derivative contracts, and currencies.

Real assets include real estate, equipment, commodities, and other physical assets.

Financial securities can be classified as debt or equity. **Debt securities** are promises to repay borrowed funds. **Equity securities** represent ownership positions.

Public (publicly traded) securities are traded on exchanges or through securities dealers and are subject to regulatory oversight. Securities that are not traded in public markets are referred to as **private securities**. Private securities are often illiquid and not subject to regulation.

Derivative contracts have values that depend on (are derived from) the values of other assets. **Financial derivative contracts** are based on equities, equity indexes, debt, debt indexes, or other financial contracts. **Physical derivative contracts** derive their values from the values of physical assets such as gold, oil, and wheat.

Markets for immediate delivery are referred to as **spot markets**. Contracts for the future delivery of physical and financial assets include forwards, futures, and options. Options provide the buyer the right, but not the obligation, to purchase (or sell) assets over some period or at some future date at predetermined prices.

The **primary market** is the market for newly issued securities. Subsequent sales of securities are said to occur in the **secondary market**.

Money markets refer to markets for debt securities with maturities of one year or less.

Capital markets refer to markets for longer-term debt securities and equity securities that have no specific maturity date.

Traditional investment markets refer to those for debt and equity. **Alternative markets** refer to those for hedge funds, commodities, real estate, collectibles, gemstones, leases, and equipment. Alternative assets are often more difficult to value, illiquid, require investor due diligence, and therefore often sell at a discount.

LOS 36.c: Describe the major types of securities, currencies, contracts, commodities, and real assets that trade in organized markets, including their distinguishing characteristics and major subtypes.

CFA® Program Curriculum, Volume 4, page 218

Assets can be classified as securities, currencies, contracts, commodities, and real assets. Their characteristics and subtypes are as follows.

Securities

Securities can be classified as fixed-income or equity securities, and individual securities can be combined in pooled investment vehicles. Corporations and governments are the most common issuers of individual securities. The initial sale of a security is called an **issue** when the security is sold to the public.

Fixed-income securities typically refer to debt securities that are promises to repay borrowed money in the future. Short-term fixed-income securities generally have a maturity of less than

one or two years; long-term term maturities are longer than five to ten years, and intermediate term maturities fall in the middle of the maturity range.

Although the terms are used loosely, *bonds* are generally long term, whereas *notes* are intermediate term. *Commercial paper* refers to short-term debt issued by firms. Governments issue *bills* and banks issue *certificates of deposit*. In *repurchase agreements*, the borrower sells a high-quality asset and has both the right and obligation to repurchase it (at a higher price) in the future. Repurchase agreements can be for terms as short as one day.

Convertible debt is debt that an investor can exchange for a specified number of equity shares of the issuing firm.

Equity securities represent ownership in a firm and include common stock, preferred stock, and warrants.

- **Common stock** is a residual claim on a firm's assets. Common stock dividends are paid only after interest is paid to debtholders and dividends are paid to preferred stockholders. Furthermore, in the event of firm liquidation, debtholders and preferred stockholders have priority over common stockholders and are usually paid in full before common stockholders receive any payment.
- **Preferred stock** is an equity security with scheduled dividends that typically do not change over the security's life and must be paid before any dividends on common stock may be paid.
- **Warrants** are similar to options in that they give the holder the right to buy a firm's equity shares (usually common stock) at a fixed exercise price prior to the warrant's expiration.

Pooled investment vehicles include mutual funds, depositories, and hedge funds. The term refers to structures that combine the funds of many investors in a portfolio of investments. The investor's ownership interests are referred to as *shares*, *units*, *depository receipts*, or *limited partnership interests*.

- **Mutual funds** are pooled investment vehicles in which investors can purchase shares, either from the fund itself (open-end funds) or in the secondary market (closed-end funds).
- **Exchange-traded funds (ETFs)** and **exchange-traded notes (ETNs)** trade like closed-end funds but have special provisions allowing conversion into individual portfolio securities, or exchange of portfolio shares for ETF shares, that keep their market prices close to the value of their proportional interest in the overall portfolio. These funds are sometimes referred to as *depositories*, with their shares referred to as *depository receipts*.
- **Asset-backed securities** represent a claim to a portion of a pool of financial assets such as mortgages, car loans, or credit card debt. The return from the assets is passed through to investors, with different classes of claims (referred to as *tranches*) having different levels of risk.
- **Hedge funds** are organized as limited partnerships, with the investors as the limited partners and the fund manager as the general partner. Hedge funds utilize various strategies and purchase is usually restricted to investors of substantial wealth and investment knowledge. Hedge funds often use leverage. Hedge fund managers are

compensated based on the amount of assets under management as well as on their investment results.



PROFESSOR'S NOTE

Asset-backed securities are described in more detail in Fixed Income. Mutual funds and ETFs are discussed in Portfolio Management. Hedge funds are discussed in Alternative Investments.

Currencies

Currencies are issued by a government's central bank. Some are referred to as **reserve currencies**, which are those held by governments and central banks worldwide. These include the dollar and euro and, secondarily, the British pound, Japanese yen, and Swiss franc. In spot currency markets, currencies are traded for immediate delivery.

Contracts

Contracts are agreements between two parties that require some action in the future, such as exchanging an asset for cash. Financial contracts are often based on securities, currencies, commodities, or security indexes (portfolios). They include futures, forwards, options, swaps, and insurance contracts.

A **forward contract** is an agreement to buy or sell an asset in the future at a price specified in the contract at its inception. An agreement to purchase 100 ounces of gold 90 days from now for \$1,000 per ounce is a forward contract. Forward contracts are not traded on exchanges or in dealer markets.

Futures contracts are similar to forward contracts except that they are standardized as to amount, asset characteristics, and delivery time and are traded on an exchange (in a secondary market) so that they are liquid investments.

In a **swap contract**, two parties make payments that are equivalent to one asset being traded (swapped) for another. In a simple *interest rate swap*, floating rate interest payments are exchanged for fixed-rate payments over multiple settlement dates. A *currency swap* involves a loan in one currency for the loan of another currency for a period of time. An *equity swap* involves the exchange of the return on an equity index or portfolio for the interest payment on a debt instrument.

An **option contract** gives its owner the right to buy or sell an asset at a specific exercise price at some specified time in the future. A **call option** gives the option buyer the right (but not the obligation) to buy an asset. A **put option** gives the option buyer the right (but not the obligation) to sell an asset.

Sellers, or writers, of call (put) options receive a payment, referred to as the *option premium*, when they sell the options but incur the obligation to sell (buy) the asset at the specified price if the option owner chooses to exercise it.

Options on currencies, stocks, stock indexes, futures, swaps, and precious metals are traded on exchanges. Customized options contracts are also sold by dealers in the over-the-counter market.

An **insurance contract** pays a cash amount if a future event occurs. They are used to hedge against unfavorable, unexpected events. Examples include life, liability, and automobile

insurance contracts. Insurance contracts can sometimes be traded to other parties and often have tax-advantaged payouts.

Credit default swaps are a form of insurance that makes a payment if an issuer defaults on its bonds. They can be used by bond investors to hedge default risk. They can also be used by parties that will experience losses if an issuer experiences financial distress and by others who are speculating that the issuer will experience more or less financial trouble than is currently expected.

Commodities

Commodities trade in spot, forward, and futures markets. They include precious metals, industrial metals, agricultural products, energy products, and credits for carbon reduction.

Futures and forwards allow both hedgers and speculators to participate in commodity markets without having to deliver or store the physical commodities.

Real Assets

Examples of **real assets** are real estate, equipment, and machinery. Although they have been traditionally held by firms for their use in production, real assets are increasingly held by institutional investors both directly and indirectly.

Buying real assets directly often provides income, tax advantages, and diversification benefits. However, they often entail substantial management costs. Furthermore, because of their heterogeneity, they usually require the investor to do substantial due diligence before investing. They are illiquid because their specialization may result in a limited pool of investors for a particular real asset.

Rather than buying real assets directly, an investor may choose to buy them indirectly through an investment such as a *real estate investment trust* (REIT) or *master limited partnership* (MLP). The investor owns an interest in these vehicles, which hold the assets directly. Indirect ownership interests are typically more liquid than ownership of the assets themselves. Another indirect ownership method is to buy the stock of firms that have large ownership of real assets.

LOS 36.d: Describe types of financial intermediaries and services that they provide.

CFA® Program Curriculum, Volume 4, page 230

Financial intermediaries stand between buyers and sellers, facilitating the exchange of assets, capital, and risk. Their services allow for greater efficiency and are vital to a well-functioning economy. Financial intermediaries include brokers and exchanges, dealers, securitizers, depository institutions, insurance companies, arbitrageurs, and clearinghouses.

Brokers, Dealers, and Exchanges

Brokers help their clients buy and sell securities by finding counterparties to trades in a cost efficient manner. They may work for large brokerage firms, for banks, or at exchanges.

Block brokers help with the placement of large trades. Typically, large trades are difficult to place without moving the market. For example, a large sell order might cause a security's

price to decrease before the order can be fully executed. Block brokers help conceal their clients' intentions so that the market does not move against them.

Investment banks help corporations sell common stock, preferred stock, and debt securities to investors. They also provide advice to firms, notably about mergers, acquisitions, and raising capital.

Exchanges provide a venue where traders can meet. Exchanges sometimes act as brokers by providing electronic order matching. Exchanges regulate their members and require firms that list on the exchange to provide timely financial disclosures and to promote shareholder democratization. Exchanges acquire their regulatory power through member agreement or from their governments.

Alternative trading systems (ATS), which serve the same trading function as exchanges but have no regulatory function, are also known as **electronic communication networks** (ECNs) or **multilateral trading facilities** (MTFs). ATS that do not reveal current client orders are known as *dark pools*.

Dealers facilitate trading by buying for or selling from their own inventory. Dealers provide liquidity in the market and profit primarily from the spread (difference) between the price at which they will buy (bid price) and the price at which they will sell (ask price) the security or other asset.

Some dealers also act as brokers. **Broker-dealers** have an inherent conflict of interest. As brokers, they should seek the best prices for their clients, but as dealers, their goal is to profit through prices or spreads. As a result, traders typically place limits on how their orders are filled when they transact with broker-dealers.

Dealers that trade with central banks when the banks buy or sell government securities in order to affect the money supply are referred to as **primary dealers**.

Securitizers

Securitizers pool large amounts of securities or other assets and then sell interests in the pool to other investors. The returns from the pool, net of the securitizer's fees, are passed through to the investors. By securitizing the assets, the securitizer creates a diversified pool of assets with more predictable cash flows than the individual assets in the pool. This creates liquidity in the assets because the ownership interests are more easily valued and traded. There are also economies of scale in the management costs of large pools of assets and potential benefits from the manager's selection of assets.

Assets that are often securitized include mortgages, car loans, credit card receivables, bank loans, and equipment leases. The primary benefit of securitization is to decrease the funding costs for the assets in the pool. A firm may set up a *special purpose vehicle* (SPV) or *special purpose entity* (SPE) to buy firm assets, which removes them from the firm's balance sheet and may increase their value by removing the risk that financial trouble at the firm will give other investors a claim to the assets' cash flows.

The cash flows from securitized assets can be segregated by risk. The different risk categories are called *tranches*. The senior tranches provide the most certain cash flows, while the junior tranches have greater risk.

Depository Institutions

Examples of **depository institutions** include banks, credit unions, and savings and loans. They pay interest on customer deposits and provide transaction services such as checking accounts. These financial intermediaries then make loans with the funds, which offer diversification benefits. The intermediaries have expertise in evaluating credit quality and managing the risk of a portfolio of loans of various types.

Other intermediaries, such as payday lenders and factoring companies, lend money to firms and individuals on the basis of their wages, accounts receivable, and other future cash flows. These intermediaries often finance the loans by issuing commercial paper or other debt securities.

Securities brokers provide loans to investors who purchase securities on margin. When this margin lending is to hedge funds and other institutions, the brokers are referred to as *prime brokers*.

The equity owners (stockholders) of banks, brokers, and other intermediaries absorb any loan losses before depositors and other lenders. The more equity capital an intermediary has, the less risk for depositors. Poorly capitalized intermediaries (those with less equity) have less incentive to reduce the risk of their loan portfolios because they have less capital at risk.

Insurance Companies

Insurance companies are intermediaries, in that they collect insurance premiums in return for providing risk reduction to the insured. The insurance firm can do this efficiently because it provides protection to a diversified pool of policyholders, whose risks of loss are typically uncorrelated. This provides more predictable losses and cash flows compared to a single insurance contract, in the same way that a bank's diversified portfolio of loans diversifies the risk of loan defaults.

Insurance firms also provide a benefit to investors by managing the risks inherent in insurance: moral hazard, adverse selection, and fraud. **Moral hazard** occurs because the insured may take more risks once he is protected against losses. **Adverse selection** occurs when those most likely to experience losses are the predominant buyers of insurance. In **fraud**, the insured purposely causes damage or claims fictitious losses so he can collect on his insurance policy.

Arbitrageurs

In its pure (riskless) form, **arbitrage** refers to buying an asset in one market and reselling it in another at a higher price. By doing so, arbitrageurs act as intermediaries, providing liquidity to participants in the market where the asset is purchased and transferring the asset to the market where it is sold.

In markets with good information, pure arbitrage is rare because traders will favor the markets with the best prices. More commonly, arbitrageurs try to exploit pricing differences for similar instruments. For example, a dealer who sells a call option will often also buy the stock because the call and stock price are highly correlated. Likewise, arbitrageurs will attempt to exploit discrepancies in the pricing of the call and stock. Many (risk) arbitrageurs use complex models for valuation of related securities and for risk control. Creating similar positions using different assets is referred to as *replication*. This is also a form of intermediation because similar risks are traded in different forms and in different markets.

Clearinghouses and Custodians

Clearinghouses act as intermediaries between buyers and sellers in financial markets and provide:

- Escrow services (transferring cash and assets to the respective parties).
- Guarantees of contract completion.
- Assurance that margin traders have adequate capital.
- Limits on the aggregate net order quantity (buy orders minus sell orders) of members.

Through these activities, clearinghouses limit **counterparty risk**, the risk that the other party to a transaction will not fulfill its obligation. In some markets, the clearinghouse ensures only the trades of its member brokers and dealers, who, in turn, ensure the trades of their retail customers.

Custodians also improve market integrity by holding client securities and preventing their loss due to fraud or other events that affect the broker or investment manager.

MODULE 36.2: POSITIONS AND LEVERAGE



LOS 36.e: Compare positions an investor can take in an asset.

Video covering this content is available online.

CFA[®] Program Curriculum, Volume 4, page 240

An investor who owns an asset, or has the right or obligation under a contract to purchase an asset, is said to have a **long position**. A **short position** can result from borrowing an asset and selling it, with the obligation to replace the asset in the future (a short sale). The party to a contract who must sell or deliver an asset in the future is also said to have a short position. In general, investors who are long benefit from an increase in the price of an asset and those who are short benefit when the asset price declines.

Hedgers use short positions in one asset to hedge an existing risk from a long position in another asset that has returns that are strongly correlated with the returns of the asset shorted. For example, wheat farmers may take a short position in (i.e., sell) wheat futures contracts. If wheat prices fall, the resulting increase in the value of the short futures position offsets, partially or fully, the loss in the value of the farmer's crop.



PROFESSOR'S NOTE

As a rule of thumb, hedgers must “do in the futures market what they must do in the future.” Thus, the farmer who must sell wheat in the future can reduce the risk from wheat price fluctuations by selling wheat futures.

The buyer of an option contract is said to be long the option. The seller is short the option and is said to have written the option. Note that an investor who is long (buys) a call option on an asset profits when the value of the underlying asset increases in value, while the party short the option has losses. A long position in a put option on an asset has the right to sell the asset at a specified price and profits when the price of the underlying asset falls, while the party short the option has losses.

In swaps, each party is long one asset and short the other, so the designation of the long and short side is often arbitrary. Usually, however, the side that benefits from an increase in the quoted price or rate is referred to as the long side.

In a currency contract, each party is long one currency and short the other. For example, the buyer of a euro futures contract priced in dollars is long the euro and short the dollar.

Short Sales and Positions

In a **short sale**, the short seller (1) simultaneously borrows and sells securities through a broker, (2) must return the securities at the request of the lender or when the short sale is closed out, and (3) must keep a portion of the proceeds of the short sale on deposit with the broker. Short sellers hope to profit from a fall in the price of the security or asset sold short, buying at a lower price in the future in order to repay the loan of the asset originally sold at a higher price. The repayment of the borrowed security or other asset is referred to as “covering the short position.”

In a short sale, the short seller must pay all dividends or interest that the lender would have received from the security that has been loaned to the short seller. These payments are called **payments-in-lieu** of dividends or interest. The short seller must also deposit the proceeds of the short sale as collateral to guarantee the eventual repurchase of the security. The broker then earns interest on these funds and may return a portion of this interest to the short seller at a rate referred to as the **short rebate rate**. The short rebate rate is usually only provided to institutional investors and is typically 0.1% less than overnight interest rates. If the security is difficult to borrow, the short rebate rate may be lower or negative. The difference between the interest earned on the proceeds from the short sale and the short rebate paid is the return to the lender of the securities. A short sale may also require the short seller to deposit additional margin in the form of cash or short-term riskless securities.

Leveraged Positions

The use of borrowed funds to purchase an asset results in a **leveraged position** and the investor is said to be using leverage. Investors who use leverage to buy securities by borrowing from their brokers are said to buy on **margin** and the borrowed funds are referred to as a **margin loan**. The interest rate paid on the funds is the **call money rate**, which is generally higher than the government bill rate. The call money rate is lower for larger investors with better collateral.

At the time of a new margin purchase, investors are required to provide a minimum amount of equity, referred to as the **initial margin requirement**. This requirement may be set by the government, exchange, clearinghouse, or broker. Lower risk in an investor’s portfolio will often result in the broker lending more funds.

The use of leverage magnifies both the gains and losses from changes in the value of the underlying asset. The additional risk from the use of borrowed funds is referred to as risk from **financial leverage**.

LOS 36.f: Calculate and interpret the leverage ratio, the rate of return on a margin transaction, and the security price at which the investor would receive a margin call.

CFA® Program Curriculum, Volume 4, page 243

The **leverage ratio** of a margin investment is the value of the asset divided by the value of the equity position. For example, an investor who satisfies an initial margin requirement of 50% equity has a 2-to-1 leverage ratio so that a 10% increase (decrease) in the price of the asset results in a 20% increase (decrease) in the investor’s equity amount.

EXAMPLE: Margin transaction

Given the following information:

Shares purchased	1,000
Purchase price per share	\$100
Annual dividend per share	\$2.00
Initial margin requirement	40%
Call money rate	4%
Commission per share	\$0.05
Stock price after one year	\$110

Calculate (1) the leverage ratio and (2) the investor's return on the margin transaction (return on equity) if the stock is sold at the end of one year.

Answer:

1. The leverage ratio = $1 / 0.40 = 2.5$.
2. The total purchase price is $1,000 \times \$100 = \$100,000$. The investor must post initial margin of $40\% \times \$100,000 = \$40,000$. The remaining $\$60,000$ is borrowed. The commission on the purchase is $1,000 \times \$0.05 = \50 . Thus, the total initial equity investment is $\$40,050$.

At the end of one year, the stock value is $1,000 \times \$110 = \$110,000$, for a gain of $\$9,950$. Dividends received are $1,000 \times \$2.00 = \$2,000$. Interest paid is $\$60,000 \times 4\% = \$2,400$. The commission on the sale is $1,000 \times \$0.05 = \50 .

The gain on the transaction in one year is $\$9,950 + \$2,000 - \$2,400 - \$50 = \$9,500$. The return on the equity investment is $\$9,500 / \$40,050 = 23.72\%$. The investor's net return is less than the asset total return (10% price appreciation + 2% dividend = 12%) multiplied by the leverage ratio ($12\% \times 2.5 = 30\%$) because of the loan interest and commissions.

We can also solve for the return on the margin transaction with the cash flow functions on a financial calculator. The initial cash outflow is the $\$40,000$ initial margin + $\$50$ purchase commission = $\$40,050$. The inflow after one year is the $\$110,000$ stock value + $\$2,000$ dividends – $\$60,000$ margin repayment – $\$2,400$ margin interest – $\$50$ sale commission = $\$49,550$. Using the cash flow functions: $CF_0 = -40,050$; $CF_1 = 49,550$; CPT IRR = 23.72% .

To ensure that the loan is covered by the value of the asset, an investor must maintain a minimum equity percentage, called the **maintenance margin requirement**, in the account. This minimum is typically 25% of the current position value, but brokers may require a greater minimum equity percentage for volatile stocks.

If the percentage of equity in a margin account falls below the maintenance margin requirement, the investor will receive a **margin call**, a request to bring the equity percentage in the account back up to the maintenance margin percentage. An investor can satisfy this request by depositing additional funds or depositing other unmargined securities that will bring the equity percentage up to the minimum requirement. If the investor does not meet the margin call, the broker must sell the position.

The stock price which results in a margin call can be calculated by using the following formula:

$$\text{margin call price} = P_0 \left(\frac{1 - \text{initial margin}}{1 - \text{maintenance margin}} \right)$$

where:

P_0 = initial purchase price

EXAMPLE: Margin call price

If an investor purchases a stock for \$40 per share with an initial margin requirement of 50% and the maintenance margin requirement is 25%, at what price will the investor get a margin call?

Answer:

$$\frac{\$40(1-0.5)}{1-0.25} = \$26.67$$

A margin call is triggered at a price below \$26.67.

In a short sale, the investor must deposit initial margin equal to a percentage of the value of the shares sold short to protect the broker in case the share price increases. An increase in the share price can decrease the margin percentage below the maintenance margin percentage and generate a margin call.



MODULE QUIZ 36.1, 36.2

To best evaluate your performance, enter your quiz answers online.

1. An investor who buys a government bond from a dealer's inventory is said to obtain:
 - A. a real asset in a primary market transaction.
 - B. a financial asset in a primary market transaction.
 - C. a financial asset in a secondary market transaction.
2. Daniel Ferramosco is concerned that a long-term bond he holds might default. He therefore buys a contract that will compensate him in the case of default. What type of contract does he hold?
 - A. Physical derivative contract.
 - B. Primary derivative contract.
 - C. Financial derivative contract.
3. A financial intermediary buys a stock and then resells it a few days later at a higher price. Which intermediary would this *most likely* describe?
 - A. Broker.
 - B. Dealer.
 - C. Arbitrageur.
4. Which of the following is *most* similar to a short position in the underlying asset?
 - A. Buying a put.
 - B. Writing a put.
 - C. Buying a call.
5. An investor buys 1,000 shares of a stock on margin at a price of \$50 per share. The initial margin requirement is 40% and the margin lending rate is 3%. The investor's broker charges a commission of \$0.01 per share on purchases and sales. The stock pays an annual dividend of \$0.30 per share. One year later, the investor sells the 1,000 shares at a price of \$56 per share. The investor's rate of return is *closest* to:
 - A. 12%.
 - B. 27%.
 - C. 36%.

MODULE 36.3: ORDER EXECUTION AND VALIDITY



Video covering
this content is
available online.

LOS 36.g: Compare execution, validity, and clearing instructions.

LOS 36.h: Compare market orders with limit orders.

CFA® Program Curriculum, Volume 4, page 246

Securities dealers provide prices at which they will buy and sell shares. The **bid price** is the price at which a dealer will buy a security. The **ask** or **offer price** is the price at which a dealer will sell a security. The difference between the bid and ask prices is referred to as the **bid-ask spread** and is the source of a dealer's compensation. The bid and ask are quoted for specific trade sizes (**bid size** and **ask size**).



PROFESSOR'S NOTE

Calculations with bid and ask prices are unlikely to appear on the Level I exam but they do appear at Level II. If you need to work with bid and ask prices, just remember that the price you get will be the one that is *worse for you*.

- Securities: If you are buying, you must pay the higher price. If you are selling, you only receive the lower price.
- Currencies: The bid or ask price you get is the one that gives you less of the currency you are acquiring. This works regardless of which way the exchange rate is quoted.

The quotation in the market is the highest dealer bid and lowest dealer ask from among all dealers in a particular security. More liquid securities have market quotations with bid-ask spreads that are lower (as a percentage of share price) and therefore have lower transactions costs for investors. Traders who post bids and offers are said to *make a market*, while those who trade with them at posted prices are said to *take the market*.

When investors want to buy or sell, they must enter orders that specify the size of the trade and whether to buy or sell. The order can also include *execution instructions* that specify how to trade, *validity instructions* that specify when the order can be filled, and *clearing instructions* that specify how to settle the trade.

Execution Instructions

The most common orders, in terms of execution instructions, are market or limit orders. A **market order** instructs the broker to execute the trade immediately at the best possible price. A **limit order** places a minimum execution price on sell orders and a maximum execution price on buy orders. For example, a buy order with a limit of \$6 will be executed immediately as long as the shares can be purchased for \$6 or less.

A market order is often appropriate when the trader wants to execute quickly, as when the trader has information she believes is not yet reflected in market prices. The disadvantage of market orders is that they may execute at unfavorable prices, especially if the security has low trading volume relative to the order size. A market buy order may execute at a high price or a market sell order may execute at a low price. Executing at an unfavorable price represents a concession by the trader for immediate liquidity. Unfortunately, these price concessions are unpredictable.

To avoid price execution uncertainty, a trader can place a limit order instead of the market order. The disadvantage of the limit order is that it might not be filled. For example, if a trader places a limit buy order of \$50 and no one is willing to sell at \$50, the order will not be filled. Furthermore, if the stock price rises over time, the trader misses out on the gains.

A limit buy order above the best ask or a limit sell order below the best bid are said to be *marketable* or *aggressively priced* because at least part of the order is likely to execute immediately. If the limit price is between the best bid and the best ask, a limit order is said to be *making a new market* or *inside the market*. Limit orders waiting to execute are called **standing limit orders**.

A limit buy order at the best bid or a limit sell order at the best ask are said to *make the market*. Again, the order might not be filled. A buy order with a limit price below the best bid, or a sell order with a limit price above the best ask, is said to be *behind the market*. It will likely not execute until security prices move toward the limit price. A limit buy order with a price considerably lower than the best bid, or a limit sell order with a price significantly higher than the best ask, is said to be *far from the market*.

Other execution instructions concern the volume of the trade. **All-or-nothing orders** execute only if the whole order can be filled. Orders can specify the minimum size of a trade, which is beneficial when trading costs depend on the number of executed trades rather than the size of the order.

Trade visibility can also be specified. **Hidden orders** are those for which only the broker or exchange knows the trade size. These are useful for investors that have a large amount to trade and do not want to reveal their intentions. Traders can also specify **display size**, where some of the trade is visible to the market, but the rest is not. These are also referred to as **iceberg orders** because part of most of the order is hidden from view. They allow the investor to advertise some of the trade, with the rest of the trade potentially executed once the visible part has executed. Sometimes entering trades for part of the position the trader wishes to establish is a way to estimate the liquidity of, or the buying interest in, the security in question.

Validity Instructions

Validity instructions specify when an order should be executed. Most orders are **day orders**, meaning they expire if unfilled by the end of the trading day. **Good til canceled orders** last until they are filled. **Immediate-or-cancel** orders are canceled unless they can be filled immediately. They are also known as **fill-or-kill** orders. **Good-on-close** orders are only filled at the end of the trading day. If they are market orders, they are referred to as **market-on-close** orders. These are often used by mutual funds because their portfolios are valued using closing prices. There are also **good-on-open** orders.

Stop orders are those that are not executed unless the stop price has been met. They are often referred to as **stop loss orders** because they can be used to prevent losses or to protect profits. Suppose an investor purchases a stock for \$50. If the investor wants to sell out of the position if the price falls 10% to \$45, he can enter a **stop-sell order** at \$45. If the stock trades down to \$45 or lower, this *triggers* a market order to sell. There is no guarantee that the order will execute at \$45, and a rapidly falling stock could be sold at a price significantly lower than \$45.

A **stop-buy** is entered with at stop (trigger) above the current market price. There are two primary reasons a trader would enter a stop-buy order. (1) A trader with a short position could attempt to limit losses from an increasing stock price with a stop-buy order. (2) It is often said, “You don’t get paid for being right until the market agrees with you.” With this in mind, an investor who believes a stock is undervalued, but does not wish to own it until there are signs that market participants are being convinced of this undervaluation, may place a stop-buy order at a price some specific percentage above the current price.

Note that stop orders reinforce market momentum. Stop-sell orders execute when market prices are falling, and stop-buy orders execute when the market is rising. Execution prices for stop orders are therefore often unfavorable.

EXAMPLE: Using stop orders

Raymond Flowers believes that the shares of Acme Corp. that he owns are overvalued currently but knows that stocks often continue to increase above their intrinsic values for some time before correcting. What type of order should Flowers place if he wants to sell his shares when the price begins to fall a significant amount?

Answer:

Flowers should enter a good til canceled stop-sell order at a price some percentage below the current level. If, for example, the shares are trading at 40, he could enter a stop-sell order at 36, 10% below the current level. Investors sometimes move these stops up as a stock continues to increase in price. In response to a price increase to 42, Flowers might move his stop-sell order up to 37.80, 10% below the new price. Note that a limit order to sell with a limit price below the current market price would likely execute immediately.

Clearing Instructions

Clearing instructions tell the trader how to clear and settle a trade. They are usually standing instructions and not attached to an order. Retail trades are typically cleared and settled by the broker, whereas institutional trades may be settled by a custodian or another broker, which might be the trader’s prime broker. Using two brokers allows the investor to keep one broker as her prime broker for margin and custodial services while using a variety of other brokers for specialized execution.

One important clearing instruction is whether a sell order is a short sale or long sale. In the former, the broker must confirm that the security can be borrowed and in the latter, that the security can be delivered.

LOS 36.i: Define primary and secondary markets and explain how secondary markets support primary markets.

CFA® Program Curriculum, Volume 4, page 252

Primary capital markets refer to the sale of newly issued securities. New equity issues involve either:

- New shares issued by firms whose shares are already trading in the marketplace. These issues are called **seasoned offerings** or **secondary issues**.
- First-time issues by firms whose shares are not currently publicly traded. These are called **initial public offerings** (IPOs).

Secondary financial markets are where securities trade after their initial issuance. Placing a buy order on the London Stock Exchange is an order in the secondary market and will result

in purchase of existing shares from their current owner.

Primary Market: Public Offerings

Corporate stock or bond issues are almost always sold with the assistance of an investment banking firm. The investment bank finds investors who agree to buy part of the issue. These are not actual orders but are referred to as **indications of interest**. When the number of shares covered by indications of interest are greater (less) than the number of shares to be offered, the offering price may be adjusted upward (downward). This process of gathering indications of interest is referred to as **book building**. In London, the book builder is referred to as the **book runner**. In Europe, an **accelerated book build** occurs when securities must be issued quickly. To build a book, the investment bank disseminates information about the firm's financials and prospects. The issuer must also make disclosures including how the funds will be used.

The most common way an investment bank assists with a security issuance is through an **underwritten offering**. Here, the investment bank agrees to purchase the entire issue at a price that is negotiated between the issuer and bank. If the issue is undersubscribed, the investment bank must buy the unsold portion. In the case of an IPO, the investment bank also agrees to make a market in the stock for a period after the issuance to provide price support for the issue.

An investment bank can also agree to distribute shares of an IPO on a **best efforts** basis, rather than agreeing to purchase the whole issue. If the issue is undersubscribed, the bank is not obligated to buy the unsold portion.

Note that investment banks have a conflict of interest in an underwritten offer. As the issuer's agents, they should set the price high to raise the most funds for the issuer. But, as underwriters, they would prefer that the price be set low enough that the whole issue sells. This also allows them to allocate portions of an undervalued IPO to their clients. This results in IPOs typically being underpriced. Issuers also could have an interest in underpricing the IPO because of the negative publicity when an undersubscribed IPO initially trades at a price below the IPO price investors pay. An IPO that is oversubscribed and has the expectation of trading significantly above its IPO price is referred to as a hot issue.

Primary Market: Private Placements and Other Transactions

In a **private placement**, securities are sold directly to qualified investors, typically with the assistance of an investment bank. Qualified investors are those with substantial wealth and investment knowledge. Private placements do not require the issuer to disclose as much information as they must when the securities are being sold to the public. The issuance costs are less with a private placement and the offer price is also lower because the securities cannot be resold in public markets, making them less valuable than shares registered for public trading.

In a **shelf registration**, a firm makes its public disclosures as in a regular offering but then issues the registered securities over time when it needs capital and when the markets are favorable.

A **dividend reinvestment plan** (DRP or DRIP) allows existing shareholders to use their dividends to buy new shares from the firm at a slight discount.

In a **rights offering**, existing shareholders are given the right to buy new shares at a discount to the current market price. Shareholders tend to dislike rights offerings because their ownership is diluted unless they exercise their rights and buy the additional shares. However, rights can be traded separately from the shares themselves in some circumstances.

In addition to firms issuing securities, governments issue short-term and long-term debt, either by auction or through investment banks.

Importance of the Secondary Market

Secondary markets are important because they provide liquidity and price/value information. Liquid markets are those in which a security can be sold quickly without incurring a discount from the current price. The better the secondary market, the easier it is for firms to raise external capital in the primary market, which results in a lower cost of capital for firms with shares that have adequate liquidity.

LOS 36.j: Describe how securities, contracts, and currencies are traded in quote-driven, order-driven, and brokered markets.

CFA® Program Curriculum, Volume 4, page 256

The trading of securities in the secondary market has encouraged the development of market structures to facilitate trading. Trading can be examined according to when securities are traded and how they are traded.

Securities markets may be structured as call markets or continuous markets. In **call markets**, the stock is only traded at specific times. Call markets are potentially very liquid when in session because all traders are present, but they are obviously illiquid between sessions. In a call market, all trades, bids, and asks are declared, and then one negotiated price is set that clears the market for the stock. This method is used in smaller markets but is also used to set opening prices and prices after trading halts on major exchanges.

In **continuous markets**, trades occur at any time the market is open. The price is set by either the auction process or by dealer bid-ask quotes.

Market Structures

There are three main categories of securities markets: *quote-driven markets* where investors trade with dealers, *order-driven markets* where rules are used to match buyers and sellers, and *brokered markets* where investors use brokers to locate a counterparty to a trade.

Quote-driven markets

In **quote-driven markets**, traders transact with dealers (market makers) who post bid and ask prices. Dealers maintain an inventory of securities. Quote-driven markets are thus sometimes called **dealer markets**, **price-driven markets**, or **over-the-counter markets**. Most securities other than stocks trade in quote-driven markets. Trading often takes place electronically.

Order-driven markets

In **order-driven markets**, orders are executed using trading rules, which are necessary because traders are usually anonymous. Exchanges and automated trading systems are

examples of order-driven markets. Two sets of rules are used in these markets: order matching rules and trade pricing rules.

Order matching rules establish an *order precedence hierarchy*. **Price priority** is one criteria, where the trades given highest priority are those at the highest bid (buy) and lowest ask (sell). If orders are at the same prices, a **secondary precedence rule** gives priority to non-hidden orders and earliest arriving orders. These rules encourage traders to price their trades aggressively, display their entire orders, and trade earlier, thereby improving liquidity.

After orders are created using order matching rules, **trade pricing rules** are used to determine the price. Under the *uniform pricing rule*, all orders trade at the same price, which is the price that results in the highest volume of trading. The *discriminatory pricing rule* uses the limit price of the order that arrived first as the trade price.

In an electronic crossing network, the typical trader is an institution. Orders are batched together and crossed (matched) at fixed points in time during the day at the average of the bid and ask quotes from the exchange where the stock primarily trades. This pricing rule is referred to as the *derivative pricing rule* because it is derived from the security's main market. The price is not determined by orders in the crossing network.

Brokered markets

In **brokered markets**, brokers find the counterparty in order to execute a trade. This service is especially valuable when the trader has a security that is unique or illiquid. Examples are large blocks of stock, real estate, and artwork. Dealers typically do not carry an inventory of these assets and there are too few trades for these assets to trade in order-driven markets.

Market Information

A market is said to be **pre-trade transparent** if investors can obtain pre-trade information regarding quotes and orders. A market is **post-trade transparent** if investors can obtain post-trade information regarding completed trade prices and sizes.

Buy-side traders value transparency because it allows them to better understand security values and trading costs. Dealers, on the other hand, prefer opaque markets because this provides them with an informational advantage over traders who trade less frequently in the security. Transactions costs and bid-ask spreads are larger in opaque markets.

LOS 36.k: Describe characteristics of a well-functioning financial system.

CFA® Program Curriculum, Volume 4, page 260

A well-functioning financial system allows entities to achieve their purposes. More specifically, **complete markets** fulfill the following:

- Investors can save for the future at fair rates of return.
- Creditworthy borrowers can obtain funds.
- Hedgers can manage their risks.
- Traders can obtain the currencies, commodities, and other assets they need.

If a market can perform these functions at low trading costs (including commissions, bid-ask spreads, and price impacts), it is said to be **operationally efficient**. If security prices reflect all the information associated with fundamental value in a timely fashion, then the financial

system is **informationally efficient**. A well-functioning financial system has complete markets that are operationally and informationally efficient, with prices that reflect fundamental values.

A well-functioning financial system has financial intermediaries that:

- Organize trading venues, including exchanges, brokerages, and alternative trading systems.
- Supply liquidity.
- Securitise assets so that borrowers can obtain funds inexpensively.
- Manage banks that use depositor capital to fund borrowers.
- Manage insurance firms that pool unrelated risks.
- Manage investment advisory services that assist investors with asset management inexpensively.
- Provide clearinghouses that settle trades.
- Manage depositories that provide for asset safety.

The benefits of a well-functioning financial system are tremendous. Savers can fund entrepreneurs who need capital to fund new companies. Company risks can be shared so that risky companies can be funded. These benefits are enhanced because the transactions can occur among strangers, widening the opportunities for capital formation and risk sharing in the economy.

Furthermore, in informationally efficient markets, capital is allocated to its most productive use. That is, they are **allocationally efficient**. Informational efficiency is brought about by traders who bid prices up and down in response to new information that changes estimates of securities' fundamental values. If markets are operationally efficient, security prices will be more informationally efficient because low trading costs encourage trading based on new information. The existence of accounting standards and financial reporting requirements also reduces the costs of obtaining information and increases security values.

LOS 36.I: Describe objectives of market regulation.

CFA® Program Curriculum, Volume 4, page 262

Without market regulation, many problems could persist in financial markets:

- *Fraud and theft*: In complex financial markets, the potential for theft and fraud increases because investment managers and others can take advantage of unsophisticated investors. Furthermore, if returns are often random, it is difficult for investors to determine if their agents (e.g., investment managers and brokers) are performing well.
- *Insider trading*: If investors believe traders with inside information will exploit them, they will exit the market and liquidity will be reduced.
- *Costly information*: If obtaining information is relatively expensive, markets will not be as informationally efficient and investors will not invest as much.
- *Defaults*: Parties might not honor their obligations in markets.

To solve these problems, market regulation should:

- Protect unsophisticated investors so that trust in the markets is preserved.
- Require minimum standards of competency and make it easier for investors to evaluate performance. The CFA Program and the Global Investment Performance Standards are part of this effort.
- Prevent insiders from exploiting other investors.
- Require common financial reporting requirements (e.g., those of the International Accounting Standards Board) so that information gathering is less expensive.
- Require minimum levels of capital so that market participants will be able to honor their long-term commitments. This is especially important for insurance companies and pension funds that individuals depend on for their financial future. With capital at stake, market participants have more incentive to be careful about the risks they take.

Regulation can be provided by governments as well as industry groups. For example, most exchanges, clearinghouses, and dealer trade organizations are self-regulating organizations (SROs), meaning that they regulate their members. Governments sometimes delegate regulatory authority to SROs.

When they fail to address the problems mentioned previously, financial markets do not function well. Liquidity declines, firms shun risky projects, new ideas go unfunded, and economic growth slows.



MODULE QUIZ 36.3

To best evaluate your performance, enter your quiz answers online.

1. A stock is selling at \$50. An investor's valuation model estimates its intrinsic value to be \$40. Based on her estimate, she would *most likely* place:
 - A. a short-sale order.
 - B. a stop order to buy.
 - C. a market order to buy.
2. Which of the following limit buy orders would be the *most likely* to go unexecuted?
 - A. A marketable order.
 - B. An order behind the market.
 - C. An order making a new market.
3. New issues of securities are transactions in:
 - A. the primary market.
 - B. the secondary market.
 - C. the seasoned market.
4. In which of the following types of markets do stocks trade any time the market is open?
 - A. Exchange markets.
 - B. Call markets.
 - C. Continuous markets.
5. A market is said to be informationally efficient if it features:
 - A. market prices that reflect all available information about the value of the securities traded.
 - B. timely and accurate information about current supply and demand conditions.
 - C. many buyers and sellers that are willing to trade at prices above and below the prevailing market price.
6. Which of the following would *least likely* be an objective of market regulation?
 - A. Reduce burdensome accounting standards.
 - B. Make it easier for investors to evaluate performance.
 - C. Prevent investors from using inside information in securities trading.

KEY CONCEPTS

LOS 36.a

The three main functions of the financial system are to:

1. Allow entities to save, borrow, issue equity capital, manage risks, exchange assets, and utilize information.
2. Determine the return that equates aggregate savings and borrowing.
3. Allocate capital efficiently.

LOS 36.b

Assets and markets can be classified as:

- Financial assets (e.g., securities, currencies, derivatives) versus real assets (e.g., real estate, equipment).
- Debt securities versus equity securities.
- Public securities that trade on exchanges or through dealers versus private securities.
- Physical derivative contracts (e.g., on grains or metals) versus financial derivative contracts (e.g., on bonds or equity indexes).
- Spot versus future delivery markets.
- Primary markets (issuance of new securities) versus secondary markets (trading of previously issued securities).
- Money markets (short-term debt instruments) versus capital markets (longer-term debt instruments and equities).
- Traditional investment markets (bonds, stocks) versus alternative investment markets (e.g., real estate, hedge funds, fine art).

LOS 36.c

The major types of assets are securities, currencies, contracts, commodities, and real assets.

Securities include fixed income (e.g., bonds, notes, commercial paper), equity (common stock, preferred stock, warrants), and pooled investment vehicles (mutual funds, exchange-traded funds, hedge funds, asset-backed securities).

Contracts include futures, forwards, options, swaps, and insurance contracts.

Commodities include agricultural products, industrial and precious metals, and energy products and are traded in spot, forward, and futures markets.

Most national currencies are traded in spot markets and some are also traded in forward and futures markets.

LOS 36.d

Financial intermediaries perform the following roles:

- Brokers, exchanges, and alternative trading systems connect buyers and sellers of the same security at the same location and time. They provide a centralized location for trading.

- Dealers match buyers and sellers of the same security at different points in time.
- Arbitrageurs connect buyers and sellers of the same security at the same time but in different venues. They also connect buyers and sellers of non-identical securities of similar risk.
- Securitizers and depository institutions package assets into a diversified pool and sell interests in it. Investors obtain greater liquidity and choose their desired risk level.
- Insurance companies create a diversified pool of risks and manage the risk inherent in providing insurance.
- Clearinghouses reduce counterparty risk and promote market integrity.

LOS 36.e

A long position in an asset represents current or future ownership. A long position benefits when the asset increases in value.

A short position represents an agreement to sell or deliver an asset or results from borrowing an asset and selling it (i.e., a short sale). A short position benefits when the asset decreases in value.

When an investor buys a security by borrowing from a broker, the investor is said to buy on margin and has a leveraged position. The risk of investing borrowed funds is referred to as financial leverage. More leverage results in greater risk.

LOS 36.f

The leverage ratio is the value of the asset divided by the value of the equity position. Higher leverage ratios indicate greater risk.

The return on a margin transaction is the increase in the value of the position after deducting selling commissions and interest charges, divided by the amount of funds initially invested, including purchase commissions.

The maintenance margin is the minimum percentage of equity that a margin investor is required to maintain in his account. If the investor's equity falls below the maintenance margin, the investor will receive a margin call. The stock price that will result in a margin call is:

$$\text{margin call price} = P_0 \left(\frac{1 - \text{initial margin}}{1 - \text{maintenance margin}} \right)$$

where:

P_0 = initial purchase price

LOS 36.g

Execution instructions specify how to trade. Market orders and limit orders are examples of execution instructions.

Validity instructions specify when an order can be filled. Day orders, good til canceled orders, and stop orders are examples of validity instructions.

Clearing instructions specify how to settle a trade.

LOS 36.h

A market order is an order to execute the trade immediately at the best possible price. A market order is appropriate when the trader wants to execute a transaction quickly. The disadvantage of a market order is that it may execute at an unfavorable price.

A limit order is an order to trade at the best possible price, subject to the price satisfying the limit condition. A limit order avoids price execution uncertainty. The disadvantage of a limit order is that it may not be filled. A buy (sell) order with a limit of \$18 will only be executed if the security can be bought (sold) at a price of \$18 or less (more).

LOS 36.i

New issues of securities are sold in primary capital markets. Secondary financial markets are where securities trade after their initial issuance.

In an underwritten offering, the investment bank guarantees that the issue will be sold at a price that is negotiated between the issuer and bank. In a best efforts offering, the bank acts only as a broker.

In a private placement, a firm sells securities directly to qualified investors, without the disclosures of a public offering.

A liquid secondary market makes it easier for firms to raise external capital in the primary market, which results in a lower cost of capital for firms.

LOS 36.j

There are three main categories of securities markets:

1. Quote-driven markets: Investors trade with dealers that maintain inventories of securities, currencies, or contracts.
2. Order-driven markets: Order-matching and trade-pricing rules are used to match the orders of buyers and sellers.
3. Brokered markets: Brokers locate a counterparty to take the other side of a buy or sell order.

In call markets, securities are only traded at specific times. In continuous markets, trades occur at any time the market is open.

LOS 36.k

A well-functioning financial system has the following characteristics:

- Complete markets: Savers receive a return, borrowers can obtain capital, hedgers can manage risks, and traders can acquire needed assets.
- Operational efficiency: Trading costs are low.
- Informational efficiency: Prices reflect fundamental information quickly.
- Allocational efficiency: Capital is directed to its highest valued use.

LOS 36.l

The objectives of market regulation are to:

- Protect unsophisticated investors.
- Establish minimum standards of competency.
- Help investors to evaluate performance.

- Prevent insiders from exploiting other investors.
- Promote common financial reporting requirements so that information gathering is less expensive.
- Require minimum levels of capital so that market participants will be able to honor their commitments and be more careful about their risks.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 36.1, 36.2

1. **C** Bonds are financial assets. Real assets are physical things such as a commodity or a factory. Buying a bond from a dealer is a secondary market transaction. A primary market transaction is an issuance of securities by an entity that is raising funds. (Module 36.1, LOS 36.b)
2. **C** Daniel holds a derivative contract that has a value determined by another financial contract; in this case, the long-term bond. (Module 36.1, LOS 36.c)
3. **B** This situation best describes a dealer. A dealer buys an asset for its inventory in the hopes of reselling it later at a higher price. Brokers stand between buyers and sellers of the same security at the same location and time. Arbitrageurs trade in the same security simultaneously in different markets. (Module 36.1, LOS 36.d)
4. **A** Buying a put is most similar to a short position in the underlying asset because the put increases in value if the underlying asset value decreases. The writer of a put and the holder of a call have a long exposure to the underlying asset because their positions increase in value if the underlying asset value increases. (Module 36.2, LOS 36.e)
5. **B** The total purchase price is $1,000 \times \$50 = \$50,000$. The investor must post initial margin of $40\% \times \$50,000 = \$20,000$. The remaining $\$30,000$ is borrowed. The commission on the purchase is $1,000 \times \$0.01 = \10 . Thus, the initial equity investment is $\$20,010$.

In one year, the sales price is $1,000 \times \$56 = \$56,000$. Dividends received are $1,000 \times \$0.30 = \300 . Interest paid is $\$30,000 \times 3\% = \900 . The commission on the sale is $1,000 \times \$0.01 = \10 . Thus, the ending value is $\$56,000 - \$30,000 + \$300 - \$900 - \$10 = \$25,390$.

The return on the equity investment is $\$25,390 / \$20,010 - 1 = 26.89\%$. (Module 36.2, LOS 36.f)

Module Quiz 36.3

1. **A** If the investor believes the stock is overvalued in the market, the investor should place a short-sale order, which would be profitable if the stock moves toward her value estimate. (LOS 36.g, 36.h)
2. **B** A behind-the-market limit order would be least likely executed. In the case of a buy, the limit buy order price is below the best bid. It will likely not execute until security prices decline. A marketable buy order is the most likely to trade because it is close to the best ask price. In an order that is making a new market or inside the market, the limit buy order price is between the best bid and ask. (LOS 36.h)
3. **A** The primary market refers to the market for newly issued securities. (LOS 36.i)
4. **C** Continuous markets are defined as markets where stocks can trade any time the market is open. Some exchange markets are call markets where orders are accumulated and executed at specific times. (LOS 36.j)

5. **A** Informational efficiency means the prevailing price reflects all available information about the value of the asset, and the price reacts quickly to new information. (LOS 36.k)
6. **A** Market regulation should require financial reporting standards so that information gathering is less expensive and the informational efficiency of the markets is enhanced. (LOS 36.l)

The following is a review of the Equity Investments (1) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #37.

READING 37: SECURITY MARKET INDEXES

Study Session 12

EXAM FOCUS

Security market indexes are used to measure the performance of markets and investment managers. Understand the construction, calculation, and weaknesses of price-weighted, market capitalization-weighted, and equal-weighted indexes. Be familiar with the various security indexes and their potential weaknesses.

MODULE 37.1: INDEX WEIGHTING METHODS



LOS 37.a: Describe a security market index.

Video covering this content is available online.

CFA[®] Program Curriculum, Volume 4, page 280

A **security market index** is used to represent the performance of an asset class, security market, or segment of a market. They are usually created as portfolios of individual securities, which are referred to as the **constituent securities** of the index. An index has a numerical value that is calculated from the market prices (actual when available, or estimated) of its constituent securities at a point in time. An index return is the percentage change in the index's value over a period of time.

LOS 37.b: Calculate and interpret the value, price return, and total return of an index.

CFA[®] Program Curriculum, Volume 4, page 281

An index return may be calculated using a **price index** or a **return index**. A price index uses only the prices of the constituent securities in the return calculation. A rate of return that is calculated based on a price index is referred to as a **price return**.

A return index includes both prices and income from the constituent securities. A rate of return that is calculated based on a return index is called a **total return**. If the assets in an index produce interim cash flows such as dividends or interest payments, the total return will be greater than the price return.

Once returns are calculated for each period, they then can be compounded together to arrive at the return for the measurement period:

$$R_P = (1 + R_{S1})(1 + R_{S2})(1 + R_{S3})(1 + R_{S4})...(1 + R_{Sk}) - 1$$

where:

R_P = portfolio return during the measurement period

k = total number of subperiods

R_{Sk} = portfolio return during the subperiod k

For example, if the returns for the first two periods were 0.50% and 1.04%, they would be geometrically linked to produce 1.55%:

$$R_P = (1 + R_{S1})(1 + R_{S2}) - 1 = (1.005)(1.0104) - 1 = 0.0155 \text{ or } 1.55\%$$

If the starting index value is 100, its value after two periods would be $100 \times 1.0155 = 101.55$.

LOS 37.c: Describe the choices and issues in index construction and management.

CFA® Program Curriculum, Volume 4, page 284

Index providers must make several decisions:

- What is the *target market* the index is intended to measure?
- Which securities from the target market should be included?
- How should the securities be weighted in the index?
- How often should the index be rebalanced?
- When should the selection and weighting of securities be re-examined?

The target market may be defined very broadly (e.g., stocks in the United States) or narrowly (e.g., small-cap value stocks in the United States). It may also be defined by geographic region or by economic sector (e.g., cyclical stocks). The constituent stocks in the index could be all the stocks in that market or just a representative sample. The selection process may be determined by an objective rule or subjectively by a committee.

LOS 37.d: Compare the different weighting methods used in index construction.

CFA® Program Curriculum, Volume 4, page 285

Weighting schemes for stock indexes include price weighting, equal weighting, market capitalization weighting, float-adjusted market capitalization weighting, and fundamental weighting.

A **price-weighted index** is simply an arithmetic average of the prices of the securities included in the index. The divisor of a price-weighted index is adjusted for stock splits and changes in the composition of the index when securities are added or deleted, such that the index value is unaffected by such changes.

The advantage of a price-weighted index is that its computation is simple. One disadvantage is that a given percentage change in the price of a higher priced stock has a greater impact on the index's value than does an equal percentage change in the price of a lower priced stock. Put another way, higher priced stocks have more weight in the calculation of a price-weighted index. Additionally, a stock's weight in the index going forward changes if the firm splits its stock, repurchases stock, or issues stock dividends, as all of these actions will affect the price of the stock and therefore its weight in the index. A portfolio that has an equal number of shares in each of the constituent stocks will have price returns (ignoring dividends) that will match the returns of a price-weighted index.

Two major price-weighted indexes are the Dow Jones Industrial Average (DJIA) and the Nikkei Dow Jones Stock Average. The DJIA is a price-weighted index based on 30 U.S.

stocks. The Nikkei Dow is constructed from the prices of 225 stocks that trade in the first section of the Tokyo Stock Exchange.

An **equal-weighted index** is calculated as the arithmetic average return of the index stocks and, for a given time period, would be matched by the returns on a portfolio that had equal dollar amounts invested in each index stock. As with a price-weighted index, an advantage of an equal-weighted index is its simplicity.

One complication with an equal-weighted index return is that a matching portfolio would have to be adjusted periodically (rebalanced) as prices change so that the values of all security positions are made equal each period. The portfolio rebalancing required to match the performance of an equal-weighted index creates high transactions costs that would decrease portfolio returns.

Another concern with an equal-weighted index is that the weights placed on the returns of the securities of smaller capitalization firms are greater than their proportions of the overall market value of the index stocks. Conversely, the weights on the returns of large capitalization firms in the index are smaller than their proportions of the overall market value of the index stocks.

The Value Line Composite Average and the Financial Times Ordinary Share Index are well-known examples of equal-weighted indexes.

A **market capitalization-weighted index** (or **value-weighted index**) has weights based on the market capitalization of each index stock (current stock price multiplied by the number of shares outstanding) as a proportion of the total market capitalization of all the stocks in the index. A market capitalization-weighted index return can be matched with a portfolio in which the value of each security position in the portfolio is the same proportion of the total portfolio value as the proportion of that security's market capitalization to the total market capitalization of all of the securities included in the index. This weighting method more closely represents changes in aggregate investor wealth than price weighting. Because the weight of an index stock is based on its market capitalization, a market capitalization-weighted index does not need to be adjusted when a stock splits or pays a stock dividend.

An alternative to using a firm's market capitalization to calculate its weight in an index is to use its **market float**. A firm's market float is the total value of the shares that are actually available to the investing public and excludes the value of shares held by controlling stockholders because they are unlikely to sell their shares. For example, the float for Microsoft would exclude shares owned by Bill Gates and Paul Allen (the founders) and those of certain other large shareholders as well. The market float is often calculated excluding those shares held by corporations or governments as well. Sometimes the market float calculation excludes shares that are not available to foreign buyers and is then referred to as the **free float**. The reason for this is to better match the index weights of stocks to their proportions of the total value of all the shares of index stocks that are actually available to investors.

A **float-adjusted market capitalization-weighted index** is constructed like a market capitalization-weighted index. The weights, however, are based on the proportionate value of each firm's shares that are available to investors to the total market value of the shares of index stocks that are available to investors. Firms with relatively large percentages of their shares held by controlling stockholders will have less weight than they have in an unadjusted market-capitalization index.

The advantage of market capitalization-weighted indexes of either type is that index security weights represent proportions of total market value. The primary disadvantage of value-weighted indexes is that the relative impact of a stock's return on the index increases as its price rises and decreases as its price falls. This means that stocks that are possibly overvalued are given disproportionately high weights in the index and stocks that are possibly undervalued are given disproportionately low weights. Holding a portfolio that tracks a value-weighted index is, therefore, similar to following a momentum strategy, under which the most successful stocks are given the greatest weights and poor performing stocks are underweighted.

The Standard and Poor's 500 (S&P 500) Index Composite is an example of a market capitalization-weighted index.

An index that uses **fundamental weighting** uses weights based on firm fundamentals, such as earnings, dividends, or cash flow. In contrast to market capitalization index weights, these weights are unaffected by the share prices of the index stocks (although related to them over the long term). Fundamental weights can be based on a single measure or some combination of fundamental measures.

An advantage of a fundamental-weighted index is that it avoids the bias of market capitalization-weighted indexes toward the performance of the shares of overvalued firms and away from the performance of the shares of undervalued firms. A fundamental-weighted index will actually have a value tilt, overweighting firms with high value-based metrics such as book-to-market ratios or earnings yields. Note that a firm with a high earnings yield (total earnings to total market value) relative to other index firms will by construction have a higher weight in an earnings-weighted index because, among index stocks, its earnings are high relative to its market value.

LOS 37.e: Calculate and analyze the value and return of an index given its weighting method.

CFA® Program Curriculum, Volume 4, page 285

Price weighting

A price-weighted index adds the market prices of each stock in the index and divides this total by the number of stocks in the index. The divisor, however, must be adjusted for stock splits and other changes in the index portfolio to maintain the continuity of the series over time.

$$\text{price-weighted index} = \frac{\text{sum of stock prices}}{\text{number of stocks in index adjusted for splits}}$$

EXAMPLE: Price-weighted index

Given the information for the three stocks presented in the following figure, calculate a price-weighted index return over a one-month period.

Index Firm Data

	Share Price December 31, 20X6	Share Price January 31, 20X7
Stock X	\$10	\$20

Stock Y	\$20	\$15
Stock Z	\$60	\$40

Answer:

The price-weighted index is $(10 + 20 + 60) / 3 = 30$ as of December 31 and $(20 + 15 + 40) / 3 = 25$ as of January 31. Hence, the price-weighted 1-month percentage return is:

$$\frac{25}{30} - 1 = -16.7\%$$

EXAMPLE: Adjusting a price-weighted index for stock splits

At the market close on day 1, Stock A has a price of \$10, Stock B has a price of \$20, and Stock C has a price of \$90. The value of a price-weighted index of these three stocks is $(10 + 20 + 90) / 3 = 40$ at the close of trading. If Stock C splits 2-for-1, effective on day 2, what is the new denominator for the index?

Answer:

The effect of the split on the price of Stock C, in the absence of any change from the price at the end of day 1, would be to reduce it to $\$90 / 2 = \45 . The index denominator will be adjusted so that the index value would remain at 40 if there were no changes in the stock prices other than to adjust for the split. The new denominator, d , must satisfy $(10 + 20 + 45) / d = 40$ and equals 1.875.

The returns on a price-weighted index could be matched by purchasing an equal number of shares of each stock represented in the index. Because the index is price weighted, a percentage change in a high-priced stock will have a relatively greater effect on the index than the same percentage change in a low-priced stock.

Market capitalization weighting

A market capitalization-weighted index is calculated by summing the total value (current stock price multiplied by the number of shares outstanding) of all the stocks in the index. This sum is then divided by a similar sum calculated during the selected base period. The ratio is then multiplied by the index's base value (typically 100).

For example, if the total market values of the index portfolio on December 31 and January 31 are \$80 million and \$95 million, respectively, the index value at the end of January is:

$$\text{current index value} = \frac{\text{current total market value of index stocks}}{\text{base year total market value of index stocks}}$$

× base year index value

$$\text{current index value} = \frac{\$95 \text{ million}}{\$80 \text{ million}} \times 100 = 118.75$$

Thus, the market capitalization-weighted index percentage return is:

$$(118.75 / 100) - 1 = 18.75\%$$

The following example of price-weighting versus market value-weighting shows how these two indexes are calculated and how they differ.

EXAMPLE: Price-weighted vs. market capitalization-weighted indexes

Consider the three firms described in the following table. Compare the effects on a price-weighted index and a market capitalization-weighted index if Stock A doubles in price or if Stock C doubles in price. Assume the period shown in the table is the base period for the market capitalization-weighted index and that its base value is 100.

Index Firm Data

Company	Number of Shares Outstanding (000s)	Stock Price	Capitalization (000s)
A	100	\$100	\$10,000
B	1,000	\$10	\$10,000
C	20,000	\$1	\$20,000

Answer:

The price-weighted index equals:

$$\frac{100+10+1}{3} = 37$$

If Stock A doubles in price to \$200, the price-weighted index value is:

$$\frac{200+10+1}{3} = 70.33$$

If Stock C doubles in price to \$2, the price-weighted index value is:

$$\frac{100+10+2}{3} = 37.33$$

If Stock A doubles in value, the index goes up 33.33 points, while if Stock C doubles in value, the index only goes up 0.33 points. Changes in the value of the firm with the highest stock price have a disproportionately large influence on a price-weighted index.

For a market capitalization-weighted index, the base period market capitalization is $(100,000 \times \$100) + (1,000,000 \times \$10) + (20,000,000 \times \$1) = \$40,000,000$.

If Stock A doubles in price to \$200, the index goes to:

$$\frac{100,000 \times \$200 + 1,000,000 \times \$10 + 20,000,000 \times \$1}{\$40,000,000} \times 100 = 125$$

If Stock C doubles in price to \$2, the index goes to:

$$\frac{100,000 \times \$100 + 1,000,000 \times \$10 + 20,000,000 \times \$2}{\$40,000,000} \times 100 = 150$$

In the market capitalization-weighted index, the returns on Stock C have the greatest influence on the index return because Stock C's market capitalization is larger than that of Stock A or Stock B.

Equal weighting

An equal-weighted index places an equal weight on the returns of all index stocks, regardless of their prices or market values. A \$2 change in the price of a \$20 stock has the same effect on the index as a \$30 change in the price of a \$300 stock regardless of the size of the company. The return of an equal-weighted index over a given period is often calculated as a simple average of the returns of the index stocks.

EXAMPLE: Equally weighted index

Calculate the equal-weighted index value for the three stocks described in the following table, assuming an initial index value of 131.

Equal-Weighted Index Data

Stock	Initial Price	Current Price	Price Change
A	\$12	\$15	+25.0%
B	\$52	\$48	-7.7%
C	\$38	\$45	+18.4%

Answer:

$$\text{change in index} = \frac{25\% - 7.7\% + 18.4\%}{3} = 11.9\%$$

$$\text{new index value} = 131(1 + 0.119) = 146.59$$

Note that for a total return index, period returns would include any dividends paid over the period.

**MODULE QUIZ 37.1**

To best evaluate your performance, enter your quiz answers online.

- Choices that must be made when constructing a security market index *least likely* include whether to:
 - use a nominal or interval scale.
 - measure the performance of an entire market or market segment.
 - weight the securities equally or by some firm-specific characteristic.

Use the information in the following table to answer Questions 2 through 4.

	As of January 1		As of December 31	
	Share Price	Number of Shares Outstanding (thousands)	Share Price	Number of Shares Outstanding (thousands)
Stock A	\$22	1,500	\$28	1,500
Stock B	\$40	10,000	\$50	10,000
Stock C	\$34	3,000	\$30	3,000

- The 1-year return on a price-weighted index of these three stocks is *closest* to:
 - 12.5%.
 - 13.5%.
 - 18.0%.
- The 1-year return on an equal-weighted index of these three stocks is *closest* to:
 - 12.0%.
 - 12.5%.
 - 13.5%.
- The 1-year return on a market capitalization-weighted index of these stocks is *closest* to:
 - 12.5%.
 - 13.5%.

- C. 18.0%.
- 5. Market float of a stock is *best* described as its:
 - A. total outstanding shares.
 - B. shares that are available to domestic investors.
 - C. outstanding shares, excluding those held by controlling shareholders.
- 6. For which of the following indexes will rebalancing occur *most* frequently?
 - A. A price-weighted index.
 - B. An equal-weighted index.
 - C. A market capitalization-weighted index.

MODULE 37.2: USES AND TYPES OF INDEXES



Video covering
this content is
available online.

LOS 37.f: Describe rebalancing and reconstitution of an index.

CFA® Program Curriculum, Volume 4, page 293

Rebalancing refers to adjusting the weights of securities in a portfolio to their target weights after price changes have affected the weights. For index calculations, rebalancing to target weights on the index securities is done on a periodic basis, usually quarterly. Because the weights in price- and value-weighted indexes (portfolios) are adjusted to their correct values by changes in prices, rebalancing is an issue primarily for equal-weighted indexes. As noted previously, the weights on security returns in an (initially) equal-weighted portfolio are not equal as securities prices change over time. Therefore, rebalancing the portfolio at the end of each period used to calculate index returns is necessary for the portfolio return to match the index return.

Index **reconstitution** refers to periodically adding and deleting securities that make up an index. Securities are deleted if they no longer meet the index criteria and are replaced by other securities that do. Indexes are reconstituted to reflect corporate events such as bankruptcy or delisting of index firms and are at the subjective judgment of a committee.

When a security is added to an index, its price tends to rise as portfolio managers seeking to track that index in a portfolio buy the security. The prices of deleted securities tend to fall as portfolio managers sell them. Note that additions and deletions also require that the weights on the returns of other index stocks be adjusted to conform to the desired weighting scheme.

LOS 37.g: Describe uses of security market indexes.

CFA® Program Curriculum, Volume 4, page 295

Security market indexes have several uses:

- *Reflection of market sentiment.* Indexes provide a representative market return and thus reflect investor confidence. Although the Dow Jones Industrial Average is a popular index, it reflects the performance of only 30 stocks and thus may not be a good measure of sentiment with regard to the broader market.
- *Benchmark of manager performance.* An index can be used to evaluate the performance of an active manager. Because portfolio performance depends to a large degree on its chosen style, the benchmark should be consistent with the manager's investment approach and style to assess the manager's skill accurately. The index stocks should be those that the manager will actually choose from. For example, a

value manager should be compared against a value index, not a broad market index, because portfolio securities will be selected from among value stocks.

- *Measure of market return and risk.* In asset allocation, estimates of the expected return and standard deviation of returns for various asset classes are based on historical returns for an index of securities representing that asset class.
- *Measure of beta and risk-adjusted return.* The use of the capital asset pricing model (CAPM) to determine a stock's expected return requires an estimate of its beta and the return on the market. Index portfolio returns are used as a proxy for the returns on the market portfolio, both in estimating a stock's beta, and then again in calculating its expected return based on its systematic (beta) risk. Expected returns can then be compared to actual stock returns to determine systematic risk-adjusted returns.
- *Model portfolio for index funds.* Investors who wish to invest passively can invest in an index fund, which seeks to replicate the performance of a market index. There are index mutual funds and index exchange-traded funds, as well as private portfolios that are structured to match the return of an index.

LOS 37.h: Describe types of equity indexes.

CFA® Program Curriculum, Volume 4, page 297

Investors can use a variety of equity market indexes. These equity indexes can be classified as follows:

- *Broad market index.* Provides a measure of a market's overall performance and usually contains more than 90% of the market's total value. For example, the Wilshire 5000 Index contains more than 6,000 equity securities and is, therefore, a good representation of the overall performance of the U.S. equity market.
- *Multi-market index.* Typically constructed from the indexes of markets in several countries and is used to measure the equity returns of a geographic region (e.g., Latin America indexes), markets based on their stage of economic development (e.g., emerging markets indexes), or the entire world (e.g., MSCI World Index).
- *Multi-market index with fundamental weighting.* Uses market capitalization-weighting for the country indexes but then weights the country index returns in the global index by a fundamental factor (e.g., GDP). This prevents a country with previously high stock returns from being overweighted in a multi-market index.
- *Sector index.* Measures the returns for an industry sector such as health care, financial, or consumer goods firms. Investors can use these indexes in cyclical analysis because some sectors do better than others in various phases of the business cycle. Sector indexes can be for a particular country or global. These indexes are used to evaluate portfolio managers and to construct index portfolios.
- *Style index.* Measures the returns to market capitalization and value or growth strategies. Some indexes reflect a combination of the two (e.g., small-cap value fund). Because there is no widely accepted definition of large-cap, mid-cap, or small-cap stocks, different indexes use different definitions. These definitions may be specified values of market capitalization or relative definitions, such as defining large-cap stocks as the largest 500 firms in a given market. In constructing value stock and growth stock indexes, price-to-earnings ratios or dividend yields are often used to identify value and growth stocks. Over time, stocks can migrate from one classification to another. For

example, a successful small-cap company might grow to become a mid-cap or large-cap company. This causes style indexes to typically have higher turnover of constituent firms than broad market indexes.

LOS 37.i: Describe types of fixed-income indexes.

CFA® Program Curriculum, Volume 4, page 300

Fixed-income securities vary widely with respect to their coupon rates, ratings, maturities, and embedded options such as convertibility to common stock. Consequently, a wide variety of fixed-income indexes is available. Like equity indexes, fixed-income indexes are created for various sectors, geographic regions, and levels of country economic development. They can also be constructed based on type of issuer or collateral, coupon, maturity, default risk, or inflation protection. Broad market indexes, sector indexes, style indexes, and other specialized indexes are available.

Investors should be aware of several issues with the construction of fixed-income indexes:

- *Large universe of securities.* The fixed-income security universe is much broader than the universe of stocks. Fixed-income securities are issued not just by firms, but also by governments and government agencies. Each of these entities may also issue various types of fixed-income securities. Also, unlike stocks, bonds mature and must be replaced in fixed-income indexes. As a result, turnover is high in fixed-income indexes.
- *Dealer markets and infrequent trading.* Fixed-income securities are primarily traded by dealers, so index providers must depend on dealers for recent prices. Because fixed-income securities are typically illiquid, a lack of recent trades may require index providers to estimate the value of index securities from recent prices of securities with similar characteristics.

The large number of fixed-income securities results in large differences in the number of index securities among fixed-income indexes. Illiquidity, transactions costs, and high turnover of constituent securities make it both difficult and expensive for fixed-income portfolio managers to replicate a fixed-income index.

LOS 37.j: Describe indexes representing alternative investments.

CFA® Program Curriculum, Volume 4, page 303

Alternative assets are of interest to investors because of their potential diversification benefits. Three of the most widely held alternative assets are commodities, real estate, and hedge funds.

Commodity indexes represent futures contracts on commodities such as grains, livestock, metals, and energy. Examples include the Thomson Reuters/Core Commodity CRB Index (previously the Commodity Research Bureau Index) and the S&P GSCI (previously the Goldman Sachs Commodity Index).

The issues in commodity indexes relevant for investors are as follows:

- *Weighting method.* Commodity index providers use a variety of weighting schemes. Some use equal weighting, others weight commodities by their global production values, and others use fixed weights that the index provider determines. As a result, different indexes have significantly different commodity exposures and risk and return

characteristics. For example, one index may have a large exposure to the prices of energy commodities while another has a large exposure to the prices of agricultural products.

- *Futures vs. actual.* Commodity indexes are based on the prices of commodity futures contracts, not the spot prices of commodities. Commodity futures contracts reflect the risk-free rate of return, changes in futures prices, and the roll yield. Furthermore, the contracts mature and must be replaced over time by other contracts. For these reasons, the return on commodity futures differs from the returns on a long position in the commodity itself.

Real estate indexes can be constructed using returns based on appraisals of properties, repeat property sales, or the performance of Real Estate Investment Trusts (REITs). REITs are similar to closed-end mutual funds in that they invest in properties or mortgages and then issue ownership interests in the pool of assets to investors. While real properties are quite illiquid, REIT shares trade like any common shares and many offer very good liquidity to investors. FTSE International produces a family of REIT indexes.

Hedge funds pool investor money and invest in nontraditional assets, using leverage (borrowed money or derivative contracts) and both long and short positions. Most **hedge fund indexes** equally weight the returns of the hedge funds included in the index.

Hedge funds are largely unregulated and are not required to report their performance to index providers. Consequently, some funds will report to one index but not another. The performance of different indexes can thus vary substantially.

Furthermore, it is often the case that those funds that report are the funds that have been successful, as the poorly performing funds do not want to publicize their performance. Funds that have reported in the past but have recently had poor returns may stop reporting their performance. The result is an upward bias in index returns, with hedge funds appearing to be better investments than they actually are.



PROFESSOR'S NOTE

Commodities (including the components of return on a commodity investment), real estate, and hedge funds (including hedge fund performance biases) are discussed further in Alternative Investments.

LOS 37.k: Compare types of security market indexes.

CFA[®] Program Curriculum, Volume 4, page 305

The following table summarizes some of the noteworthy characteristics of various global indexes. Notice from the table that most security market indexes are market capitalization-weighted and often adjusted for the float (securities actually available for purchase). The number of securities in many of these indexes can vary.

Index	Reflects	Number of Constituent Securities	Weighting Method	Notes
Dow Jones Industrial Average	Large U.S. stocks	30	Price	Stocks are chosen by Wall Street Journal editors

Nikkei Stock Average	Large Japanese stocks	225	Modified price	Price weighted and adjusted for high-priced shares
TOPIX	All stocks on the Tokyo Stock Exchange First Section	Variable	Market capitalization, adjusted for float	Has a large number of small illiquid stocks making it hard to replicate. Contains 93% of the market cap of Japanese equities
MSCI All Country World Index	Stocks in 23 developed and 24 emerging markets	Variable	Market capitalization, adjusted for float	Available in both U.S. dollars and local currency
S&P Developed Ex-U.S. BMI Energy Sector Index	Global energy stocks outside the United States	Variable	Market capitalization, adjusted for float	Is the model portfolio for an ETF
Barclays Capital Global Aggregate Bond Index	Global investment-grade bonds	Variable	Market capitalization	Formerly compiled by Lehman Brothers
Markit iBoxx Euro High-Yield Bond Indexes	Below investment-grade bonds	Variable	Market capitalization	Represents liquid portion of market and rebalanced monthly
FTSE EPRA/NAREIT Global Real Estate Index	Global real estate	Variable	Market capitalization, adjusted for float	Represents publicly traded REITs
HFRX Global Hedge Fund Index	Global hedge funds	Variable	Asset weighted	Contains a variety of hedge fund strategies and is weighted based on the amount invested in each hedge fund
HFRX Equal Weighted Strategies EUR Index	Global hedge funds	Variable	Equal weighted	Contains same strategy funds as HFRX Global Hedge Fund Index and is equal weighted
Morningstar Style Indexes	U.S. stocks grouped by value/growth and market cap	Variable	Market capitalization, adjusted for float	Nine categories classified by combinations of three cap categories and three value/growth categories



MODULE QUIZ 37.2

To best evaluate your performance, enter your quiz answers online.

1. The publisher of an index that includes 50 corporate bonds removes from the index three bonds that are nearing maturity and one whose issuer has defaulted and selects four actively traded bonds to replace them in the index. This bond index is said to have been:
 - A. redefined.
 - B. rebalanced.
 - C. reconstituted.
2. Which of the following would *most likely* represent an inappropriate use of an index?
 - A. As a reflection of market sentiment.
 - B. Comparing a small-cap manager against a broad market.
 - C. Using the CAPM to determine the expected return and beta.
3. An index of 200 mid-cap growth stocks is *best* described as:
 - A. a style index.
 - B. a sector index.
 - C. a broad market index.
4. Which of the following is *least accurate* regarding fixed-income indexes?
 - A. Replicating the return on a fixed-income security index is difficult for investors.
 - B. There is a great deal of heterogeneity in the composition of fixed-income security indexes.
 - C. Due to the large universe of fixed-income security issues, data for fixed-income securities are relatively easy to obtain.
5. Which of the following indexes of alternative investments is *most likely* to be calculated from derivatives prices?
 - A. Real estate index.
 - B. Commodity index.
 - C. Hedge fund index.
6. Most of the widely used global security indexes are:
 - A. price weighted.
 - B. equal weighted.
 - C. market capitalization weighted.

KEY CONCEPTS

LOS 37.a

A security market index represents the performance of an asset class, security market, or segment of a market. The performance of the market or segment over a period of time is represented by the percentage change in (i.e., the return on) the value of the index.

LOS 37.b

A price index uses only the prices of the constituent securities in the return calculation. The rate of return is called a price return.

A total return index uses both the price of and the income from the index securities in the return calculation.

LOS 37.c

Decisions that index providers must make when constructing and managing indexes include:

- The target market the index will measure.
- Which securities from the target market to include.
- The appropriate weighting method.
- How frequently to rebalance the index to its target weights.
- How frequently to re-examine the selection and weighting of securities.

LOS 37.d

A price-weighted index is the arithmetic mean of the prices of the index securities. The divisor, which is initially equal to the number of securities in the index, must be adjusted for stock splits and changes in the composition of the index over time.

An equal-weighted index assigns the same weight to each of its constituent securities.

A market capitalization-weighted index gives each constituent security a weight equal to its proportion of the total market value of all securities in the index. Market capitalization can be adjusted for a security's market float or free float to reflect the fact that not all outstanding shares are available for purchase.

A fundamental-weighted index uses weights that are independent of security prices, such as company earnings, revenue, assets, or cash flow.

LOS 37.e

$$\text{Price-weighted index} = \frac{\text{sum of stock prices}}{\text{number of stocks in index adjusted for splits}}$$

Market capitalization-weighted index =

$$\frac{\text{current total market value of index stocks}}{\text{base year total market value of index stocks}} \times \text{base year index value}$$

$$\text{Equal-weighted index} = (1 + \text{average percentage change in index stocks}) \times \text{initial index value}$$

LOS 37.f

Index providers periodically rebalance the weights of the constituent securities. This is most important for equal-weighted indexes.

Reconstitution refers to changing the securities that are included in an index. This is necessary when securities mature or when they no longer have the required characteristics to be included.

LOS 37.g

Indexes are used for the following purposes:

- Reflection of market sentiment.
- Benchmark of manager performance.
- Measure of market return.
- Measure of beta and excess return.
- Model portfolio for index funds.

LOS 37.h

Broad market equity indexes represent the majority of stocks in a market.

Multi-market equity indexes contain the indexes of several countries. Multi-market equity indexes with fundamental weighting use market capitalization weighting for the securities within a country's market but then weight the countries within the global index by a fundamental factor.

Sector indexes measure the returns for a sector (e.g., health care) and are useful because some sectors do better than others in certain business cycle phases. These indexes are used to evaluate portfolio managers and as models for sector investment funds.

Style indexes measure the returns to market capitalization and value or growth strategies. Stocks tend to migrate among classifications, which causes style indexes to have higher constituent turnover than broad market indexes.

LOS 37.i

Fixed-income indexes can be classified by issuer, collateral, coupon, maturity, credit risk (e.g., investment grade versus high-yield), and inflation protection. They can be delineated as broad market, sector, style, or other specialized indexes. Indexes exist for various sectors, regions, and levels of development.

The fixed-income security universe is much broader than the equity universe, and fixed-income indexes have higher turnover. Index providers must depend on dealers for fixed-income security prices, and the securities are often illiquid. Fixed-income security indexes vary widely in their numbers of constituent securities and can be difficult and expensive to replicate.

LOS 37.j

Indexes have been developed to represent markets for alternative assets such as commodities, real estate, and hedge funds.

Issues in creating commodity indexes include the weighting method (different indexes can have vastly different commodity weights and resulting risk and return) and the fact that commodity indexes are based on the performance of commodity futures contracts, not the

actual commodities, which can result in different performance for a commodity index versus the actual commodity.

Real estate indexes include appraisal indexes, repeat property sales indexes, and indexes of real estate investment trusts.

Because hedge funds report their performance to index providers voluntarily, the performance of different hedge fund indexes can vary substantially and index returns have an upward bias.

LOS 37.k

Security market indexes available from commercial providers represent a variety of asset classes and reflect target markets that can be classified by:

- Geographic location, such as country, regional, or global indexes.
- Sector or industry, such as indexes of energy producers.
- Level of economic development, such as emerging market indexes.
- Fundamental factors, such as indexes of value stocks or growth stocks.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 37.1

1. **A** To be useful, a security market index must have a numerical value. Selecting the target market and determining the weighting method are among the choices that must be made when constructing a securities index. (LOS 37.a, 37.c)
2. **A** $\frac{22+40+34}{3} = 32$, $\frac{28+50+30}{3} = 36$, $\frac{36}{32} - 1 = 0.125 = 12.5\%$
(LOS 37.b, 37.d, 37.e)
3. **C** $\left[\left(\frac{28}{22} - 1 \right) + \left(\frac{50}{40} - 1 \right) + \left(\frac{30}{34} - 1 \right) \right] \left(\frac{1}{3} \right) = 0.135 = 13.5\%$
(LOS 37.b, 37.d, 37.e)
4. **C** Total portfolio value January 1:
 $22(1,500) + 40(10,000) + 34(3,000) = \$535,000$
Total portfolio value December 31:
 $28(1,500) + 50(10,000) + 30(3,000) = \$632,000$
 $\frac{632}{535} - 1 = 0.1813 \approx 18\%$
From a base value of 100, the December 31 index value would be $\frac{632}{535} \times 100 = 118.13$.
(LOS 37.b, 37.d, 37.e)
5. **C** Market float represents shares available to the investing public and excludes shares held by controlling shareholders. Free float is a narrower measure that also excludes shares that are not available to foreign investors. (LOS 37.d)
6. **B** An equal-weighted index will be rebalanced most frequently because as stock prices change, their representation in the index needs to be adjusted. Price-weighted and market capitalization-weighted indexes do not usually need rebalancing. (LOS 37.d)

Module Quiz 37.2

1. **C** Changing the constituent securities of an index is referred to as reconstituting the index. Rebalancing refers to adjusting the index weights to their target levels. (LOS 37.f)
2. **B** Comparing a small-cap manager against a broad market would be an inappropriate use of an index. A benchmark should be consistent with the manager's investment approach and style. A manager's performance will depend to a large degree on its chosen style. (LOS 37.g)
3. **A** An index for mid-cap growth stocks is best described as a style index. Sector indexes typically measure returns for a specific industry or sector of the economy (e.g., utilities or financial services firms). (LOS 37.h)

4. **C** Fixed-income securities are largely traded by dealers and trade infrequently. Data are therefore difficult to obtain. (LOS 37.i)
5. **B** Commodity indexes are typically calculated from prices of commodity futures contracts. (LOS 37.j)
6. **C** Most global security indexes are market capitalization-weighted with a float adjustment to reflect the amount of shares available to investors. (LOS 37.k)

The following is a review of the Equity Investments (1) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #38.

READING 38: MARKET EFFICIENCY

Study Session 12

EXAM FOCUS

The informational efficiency of market prices is a very important concept to a portfolio manager. When markets are truly efficient, careful analysis and security selection using publicly available information will not lead to positive risk-adjusted returns on average. For the exam, you must understand the three forms of market efficiency and know the evidence from tests of each form of market efficiency. Focus your attention on the implications of this evidence about the value of technical and fundamental analysis and about the role of portfolio managers in the investment process. Finally, be familiar with market anomalies listed and the perspective provided by behavioral finance.

MODULE 38.1: MARKET EFFICIENCY



LOS 38.a: Describe market efficiency and related concepts, including their importance to investment practitioners.

Video covering this content is available online.

CFA[®] Program Curriculum, Volume 4, page 319

An **informationally efficient capital market** is one in which the current price of a security fully, quickly, and rationally reflects all available information about that security. This is really a statistical concept. An academic might say, “Given all available information, current securities prices are unbiased estimates of their values, so that the expected return on any security is just the equilibrium return necessary to compensate investors for the risk (uncertainty) regarding its future cash flows.” This concept is often put more intuitively as, “You can’t beat the market.”

In a perfectly efficient market, investors should use a **passive investment** strategy (i.e., buying a broad market index of stocks and holding it) because **active investment** strategies will underperform due to transactions costs and management fees. However, to the extent that market prices are inefficient, active investment strategies can generate positive risk-adjusted returns.

One method of measuring a market’s efficiency is to determine the time it takes for trading activity to cause information to be reflected in security prices (i.e., the lag from the time information is disseminated to the time prices reflect the value implications of that information). In some very efficient markets, such as foreign currency markets, this lag can be as short as a minute. If there is a significant lag, informed traders can use the information to potentially generate positive risk-adjusted returns.

Note that market prices should not be affected by the release of information that is well anticipated. Only new information (information that is unexpected and changes expectations) should move prices. The announcement that a firm’s earnings were up 45% over the last

quarter may be good news if the expected increase was 20%. On the other hand, this may be bad news if a 70% increase was anticipated or no news at all if market participants correctly anticipated quarterly earnings.

LOS 38.b: Distinguish between market value and intrinsic value.

CFA® Program Curriculum, Volume 4, page 321

The **market value** of an asset is its current price. The **intrinsic value** or **fundamental value** of an asset is the value that a rational investor with full knowledge about the asset's characteristics would willingly pay. For example, a bond investor would fully know and understand a bond's coupon, maturity, default risk, liquidity, and other characteristics and would use these to estimate its intrinsic value.

In markets that are highly efficient, investors can typically expect market values to reflect intrinsic values. If markets are not completely efficient, active managers will buy assets for which they think intrinsic values are greater than market values and sell assets for which they think intrinsic values are less than market values.

Intrinsic values cannot be known with certainty and are estimated by investors who will have differing estimates of an asset's intrinsic value. The more complex an asset, the more difficult it is to estimate its intrinsic value. Furthermore, intrinsic value is constantly changing as new (unexpected) information becomes available.

LOS 38.c: Explain factors that affect a market's efficiency.

CFA® Program Curriculum, Volume 4, page 322

Markets are generally neither perfectly efficient nor completely inefficient. The degree of informational efficiency varies across countries, time, and market types. The following factors affect the degree of market efficiency.

Number of market participants. The larger the number of investors, analysts, and traders who follow an asset market, the more efficient the market. The number of participants can vary through time and across countries. For example, some countries prevent foreigners from trading in their markets, reducing market efficiency.

Availability of information. The more information is available to investors, the more efficient the market. In large, developed markets such as the New York Stock Exchange, information is plentiful and markets are quite efficient. In emerging markets, the availability of information is lower, and consequently, market prices are relatively less efficient. Some assets, such as bonds, currencies, swaps, forwards, mortgages, and money market securities that trade in over-the-counter (OTC) markets, may have less available information.

Access to information should not favor one party over another. Therefore, regulations such as the U.S. Securities and Exchange Commission's Regulation FD (fair disclosure) require that firms disclose the same information to the public that they disclose to stock analysts. Traders with material inside information about a firm are prohibited from trading on that information.

Impediments to trading. **Arbitrage** refers to buying an asset in one market and simultaneously selling it at a higher price in another market. This buying and selling of assets will continue until the prices in the two markets are equal. Impediments to arbitrage, such as

high transactions costs or lack of information, will limit arbitrage activity and allow some price inefficiencies (i.e., mispricing of assets) to persist.

Short selling improves market efficiency. The sales pressure from short selling prevents assets from becoming overvalued. Restrictions on short selling, such as an inability to borrow stock cheaply, can reduce market efficiency.

Transaction and information costs. To the extent that the costs of information, analysis, and trading are greater than the potential profit from trading misvalued securities, market prices will be inefficient. It is generally accepted that markets are efficient if, after deducting costs, there are no risk-adjusted returns to be made from trading based on publicly available information.

LOS 38.d: Contrast weak-form, semi-strong-form, and strong-form market efficiency.

CFA® Program Curriculum, Volume 4, page 326

Professor Eugene Fama originally developed the concept of market efficiency and identified three forms of market efficiency. The difference among them is that each is based on a different set of information.

1. **Weak-form market efficiency.** The weak form of the efficient markets hypothesis (EMH) states that current security prices *fully reflect all currently available security market data*. Thus, past price and volume (market) information will have no predictive power about the future direction of security prices because price changes will be independent from one period to the next. In a weak-form efficient market, an investor cannot achieve positive risk-adjusted returns on average by using technical analysis.
2. **Semi-strong-form market efficiency.** The semi-strong form of the EMH holds that security prices rapidly adjust without bias to the arrival of all new public information. As such, current security prices *fully reflect all publicly available information*. The semi-strong form says security prices include all past security market information and nonmarket information available to the public. The implication is that an investor cannot achieve positive risk-adjusted returns on average by using fundamental analysis.
3. **Strong-form market efficiency.** The strong form of the EMH states that security prices *fully reflect all information from both public and private sources*. The strong form includes all types of information: past security market information, public, and private (inside) information. This means that no group of investors has monopolistic access to information relevant to the formation of prices, and none should be able to consistently achieve positive abnormal returns.

Given the prohibition on insider trading in most markets, it would be unrealistic to expect markets to reflect all private information. The evidence supports the view that markets are not strong-form efficient.



PROFESSOR'S NOTE

As a base level knowledge of the EMH, you should know that the weak form is based on past security market information; the semi-strong form is based on all public information (including market information); and the strong form is based on both public information and inside or private information.

LOS 38.e: Explain the implications of each form of market efficiency for fundamental analysis, technical analysis, and the choice between active and passive portfolio

Abnormal profit (or **risk-adjusted returns**) calculations are often used to test market efficiency. To calculate abnormal profits, the expected return for a trading strategy is calculated given its risk, using a model of expected returns such as the CAPM or a multifactor model. If returns are, on average, greater than equilibrium expected returns, we can reject the hypothesis of efficient prices with respect to the information on which the strategy is based.

The results of tests of the various forms of market efficiency have implications about the value of technical analysis, fundamental analysis, and portfolio management in general.

Technical analysis seeks to earn positive risk-adjusted returns by using historical price and volume (trading) data. Tests of weak-form market efficiency have examined whether technical analysis produces abnormal profits. Generally, the evidence indicates that technical analysis does not produce abnormal profits, so we cannot reject the hypothesis that markets are weak-form efficient. However, technical analysis has been shown to have success in emerging markets, and there are so many possible technical analysis trading strategies that they cannot all be tested. As noted previously, the success of any technical analysis strategy should be evaluated considering the costs of information, analysis, and trading.

Fundamental analysis is based on public information such as earnings, dividends, and various accounting ratios and estimates. The semi-strong form of market efficiency suggests that all public information is already reflected in stock prices. As a result, investors should not be able to earn abnormal profits by trading on this information.

One method of testing the semi-strong form is an **event study**. Event studies examine abnormal returns before and after the release of new information that affects a firm's intrinsic value, such as earnings announcements or dividend changes. The null hypothesis is that investors should not be able to earn positive abnormal returns on average by trading based on firm events because prices will rapidly reflect news about a firm's prospects. The evidence in developed markets indicates that markets are generally semi-strong form efficient. However, there is evidence of semi-strong form inefficiency in some emerging markets.

The evidence that developed markets are generally semi-strong form efficient raises questions about the usefulness of fundamental analysis. It must be fundamental analysis, however, that results in informationally efficient market prices. Fundamental analysis can also be of use to those exceptionally skilled investors who can generate abnormal profits through its use and to those who act rapidly before new information is reflected in prices.



PROFESSOR'S NOTE

Markets can be weak-form efficient without being semi-strong or strong-form efficient. If markets are semi-strong form efficient, they must be weak-form efficient because public information includes market information, but semi-strong form efficient markets need not be strong-form efficient.

Active vs. Passive Portfolio Management

If markets are semi-strong form efficient, investors should invest passively (i.e., invest in an index portfolio that replicates the returns on a market index). Indeed, the evidence shows that most mutual fund managers cannot outperform a passive index strategy over time.

If so, what is the role of a portfolio manager? Even if markets are efficient, portfolio managers can add value by establishing and implementing portfolio risk and return objectives and by assisting clients with portfolio diversification, asset allocation, and tax management.

LOS 38.f: Describe market anomalies.

CFA® Program Curriculum, Volume 4, page 332

An anomaly is something that deviates from the common rule. Tests of the EMH are frequently called *anomaly studies*, so in the efficient markets literature, a **market anomaly** is something that would lead us to reject the hypothesis of market efficiency.

Just by chance, some variables will be related to abnormal returns over a given period, although in fact these relationships are unlikely to persist over time. Thus, analysts using historical data can find patterns in security returns that appear to violate market efficiency but are unlikely to recur in the future. If the analyst uses a 5% significance level and examines the relationship between stock returns and 40 variables, two of the variables are expected to show a statistically significant relationship with stock returns by random chance. Recall that the significance level of a hypothesis test is the probability that the null hypothesis (efficiency here) will be rejected purely by chance, even when it is true. Investigating data until a statistically significant relation is found is referred to as **data mining** or **data snooping**. Note that 1,000 analysts, each testing different hypotheses on the same data set, could produce the same results as a single researcher who performed 1,000 hypothesis tests.

To avoid data-mining bias, analysts should first ask if there is an economic basis for the relationships they find between certain variables and stock returns and then test the discovered relationships with a large sample of data to determine if the relationships are persistent and present in various subperiods.

Anomalies in time-series data

Calendar anomalies. The **January effect** or **turn-of-the-year effect** is the finding that during the first five days of January, stock returns, especially for small firms, are significantly higher than they are the rest of the year. In an efficient market, traders would exploit this profit opportunity in January, and in so doing, eliminate it.

Possible explanations for the January effect are **tax-loss selling**, as investors sell losing positions in December to realize losses for tax purposes and then repurchase stocks in January, pushing their prices up, and **window dressing**, as portfolio managers sell risky stocks in December to remove them from their year-end statements and repurchase them in January. Evidence indicates that each of these explains only a portion of the January effect. However, after adjustments are made for risk, the January effect does not appear to persist over time.

Other calendar anomalies that were found at one time but no longer appear to persist are the *turn-of-the-month effect* (stock returns are higher in the days surrounding month end), the *day-of-the-week effect* (average Monday returns are negative), the *weekend effect* (positive Friday returns are followed by negative Monday returns), and the *holiday effect* (pre-holiday returns are higher).

Overreaction and momentum anomalies. The **overreaction effect** refers to the finding that firms with poor stock returns over the previous three or five years (losers) have better

subsequent returns than firms that had high stock returns over the prior period. This pattern has been attributed to investor overreaction to both unexpected good news and unexpected bad news. This pattern is also present for bonds and in some international markets.

Momentum effects have also been found where high short-term returns are followed by continued high returns. This pattern is present in some international markets as well.

Both the overreaction and momentum effects violate the weak form of market efficiency because they provide evidence of a profitable strategy based only on market data. Some researchers argue that the evidence of overreaction to new information is due to the nature of the statistical tests used and that evidence of momentum effects in securities prices reflects rational investor behavior.

Anomalies in cross-sectional data

The **size effect** refers to initial findings that small-cap stocks outperform large-cap stocks. This effect could not be confirmed in later studies, suggesting that either investors had traded on, and thereby eliminated, this anomaly or that the initial finding was simply a random result for the time period examined.

The **value effect** refers to the finding that **value stocks** [those with lower price-to-earnings (P/E), lower market-to-book (M/B), and higher dividend yields] have outperformed **growth stocks** (those with higher P/E, higher M/B, and lower dividend yields). This violates the semi-strong form of market efficiency because the information necessary to classify stocks as value or growth is publicly available. However, some researchers attribute the value effect to greater risk of value stocks that is not captured in the risk adjustment procedure used in the studies.

Other anomalies

Closed-end investment funds. The shares of **closed-end investment funds** trade at prices that sometimes deviate from the **net asset value** (NAV) of the fund shares, often trading at large discounts to NAV. Such large discounts are an anomaly because, by arbitrage, the value of the pool of assets should be the same as the market price for closed-end shares. Various explanations have been put forth to explain this anomaly, including management fees, taxes on future capital gains, and share illiquidity. None of these explanations fully explains the pricing discrepancy. However, transactions costs would eliminate any profits from exploiting the unexplained portion of closed-end fund discounts.

Earnings announcements. An **earnings surprise** is that portion of announced earnings that was not expected by the market. Positive earnings surprises (earnings higher than expected) precede periods of positive risk-adjusted post-announcement stock returns, and negative surprises lead to predictable negative risk-adjusted returns. The anomaly is that the adjustment process does not occur entirely on the announcement day. Investors could exploit this anomaly by buying positive earnings surprise firms and selling negative earnings surprise firms. Some researchers argue that evidence of predictable abnormal returns after earnings surprises is a result of estimating risk-adjusted returns incorrectly in the tests and that transactions costs would eliminate any abnormal profits from attempting to exploit this returns anomaly.

Initial public offerings. IPOs are typically underpriced, with the offer price below the market price once trading begins. However, the long-term performance of IPO shares as a

group is below average. This suggests that investors overreact, in that they are too optimistic about a firm's prospects on the offer day. Some believe this is not an anomaly, but rather a result of the statistical methodologies used to estimate abnormal returns.



PROFESSOR'S NOTE

The initial underpricing of IPOs is also discussed in the topic review of Market Organization and Structure.

Economic fundamentals. Research has found that stock returns are related to known economic fundamentals such as dividend yields, stock volatility, and interest rates. However, we would expect stock returns to be related to economic fundamentals in efficient markets. The relationship between stock returns and dividend yields is also not consistent over all time periods.

Implications for investors

The majority of the evidence suggests that reported anomalies are not violations of market efficiency but are due to the methodologies used in the tests of market efficiency. Furthermore, both underreaction and overreaction have been found in the markets, meaning that prices are efficient on average. Other explanations for the evidence of anomalies are that they are transient relations, too small to profit from, or simply reflect returns to risk that the researchers have failed to account for.

The bottom line for investors is that portfolio management based on previously identified anomalies will likely be unprofitable. Investment management based solely on anomalies has no sound economic basis.

LOS 38.g: Describe behavioral finance and its potential relevance to understanding market anomalies.

CFA® Program Curriculum, Volume 4, page 338

Behavioral finance examines the actual decision-making processes of investors. Many observers have concluded that investors are not the rational utility-maximizing decision makers with complete information that traditional finance assumes they are. Investors appear to exhibit bias in their decision making, base decisions on the actions of others, and not evaluate risk in the way traditional models assume they do.

Various types of investor irrationality have been proposed as explanations for reported pricing anomalies. Whether widespread investor irrationality is the underlying cause of reported returns anomalies is an open question. Market efficiency does not require an assumption that every investor acts rationally in accordance with traditional finance theory. Semi-strong form market efficiency requires that investors cannot earn positive abnormal returns on average (beat the market) using public information. The evidence on market efficiency certainly suggests that this is the case. Evidence that some investors exhibit bias, or other deviations from perfect rationality, in their investment decision making does not necessarily mean that market prices themselves are irrational, at least not in ways that lead to violations of market efficiency.

Observed investor behaviors and biases that are considered evidence of irrational behavior include:

- **Loss aversion**, which refers to the tendency of investors to be more risk averse when faced with potential losses than they are when faced with potential gains. Put another way, investors dislike a loss more than they like a gain of an equal amount.
- **Investor overconfidence**, which is a tendency of investors to overestimate their abilities to analyze security information and identify differences between securities' market prices and intrinsic values.
- **Herding**, which is a tendency of investors to act in concert on the same side of the market, acting not on private analysis, but mimicking the investment actions of other investors.

An **information cascade** results when investors mimic the decisions of others. The idea is that uninformed or less-informed traders watch the actions of informed traders and follow their investment actions. If those who act first are more knowledgeable investors, others following their actions may, in fact, be part of the process of incorporating new information into securities prices and actually move market prices toward their intrinsic values, improving informational efficiency.

Behavioral finance can explain how securities' market prices can deviate from rational prices and be biased estimates of intrinsic value. If investor rationality is viewed as a prerequisite for market efficiency, then markets are not efficient. If market efficiency only requires that investors cannot consistently earn abnormal risk-adjusted returns, then research supports the belief that markets are efficient.



MODULE QUIZ 38.1

To best evaluate your performance, enter your quiz answers online.

1. In an informationally efficient capital market:
 - A. active managers can generate abnormal profits.
 - B. security prices quickly reflect new information.
 - C. investors react to all information releases rapidly.
2. The intrinsic value of an asset:
 - A. changes through time as new information is released.
 - B. is the price at which the asset can be bought or sold at a given point in time.
 - C. can be easily determined with a financial calculator, given investor risk preferences.
3. In terms of market efficiency, short selling *most likely*:
 - A. leads to excess volatility, which reduces market efficiency.
 - B. promotes market efficiency by making assets less likely to become overvalued.
 - C. has little effect on market efficiency because short sellers face the risk of unlimited losses.
4. The weak-form EMH asserts that stock prices fully reflect which of the following types of information?
 - A. Market only.
 - B. Market and public.
 - C. Public and private.
5. Research has revealed that the performance of professional money managers tends to be:
 - A. equal to the performance of a passive investment strategy.
 - B. inferior to the performance of a passive investment strategy.
 - C. superior to the performance of a passive investment strategy.
6. Which of the following *best* describes the majority of the evidence regarding anomalies in stock returns?
 - A. Weak-form market efficiency holds, but semi-strong form efficiency does not.
 - B. Neither weak-form nor semi-strong form market efficiency holds.

- C. Reported anomalies are not violations of market efficiency but are the result of research methodologies.
7. Investors who exhibit loss aversion *most likely*:
- A. have symmetric risk preferences.
 - B. are highly risk averse.
 - C. dislike losses more than they like equal gains.

KEY CONCEPTS

LOS 38.a

In an informationally efficient capital market, security prices reflect all available information fully, quickly, and rationally. The more efficient a market is, the quicker its reaction will be to new information. Only unexpected information should elicit a response from traders.

If the market is fully efficient, active investment strategies cannot earn positive risk-adjusted returns consistently, and investors should therefore use a passive strategy.

LOS 38.b

An asset's market value is the price at which it can currently be bought or sold.

An asset's intrinsic value is the price that investors with full knowledge of the asset's characteristics would place on the asset.

LOS 38.c

Large numbers of market participants and greater information availability tend to make markets more efficient.

Impediments to arbitrage and short selling and high costs of trading and gathering information tend to make markets less efficient.

LOS 38.d

The weak form of the efficient markets hypothesis (EMH) states that security prices fully reflect all past price and volume information.

The semi-strong form of the EMH states that security prices fully reflect all publicly available information.

The strong form of the EMH states that security prices fully reflect all public and private information.

LOS 38.e

If markets are weak-form efficient, technical analysis does not consistently result in abnormal profits.

If markets are semi-strong form efficient, fundamental analysis does not consistently result in abnormal profits. However, fundamental analysis is necessary if market prices are to be semi-strong form efficient.

If markets are strong-form efficient, active investment management does not consistently result in abnormal profits.

Even if markets are strong-form efficient, portfolio managers can add value by establishing and implementing portfolio risk and return objectives and assisting with portfolio diversification, asset allocation, and tax minimization.

LOS 38.f

A market anomaly is something that deviates from the efficient market hypothesis. Most evidence suggests anomalies are not violations of market efficiency but are due to the

methodologies used in anomaly research, such as data mining or failing to adjust adequately for risk.

Anomalies that have been identified in time-series data include calendar anomalies such as the January effect (small firm stock returns are higher at the beginning of January), overreaction anomalies (stock returns subsequently reverse), and momentum anomalies (high short-term returns are followed by continued high returns).

Anomalies that have been identified in cross-sectional data include a size effect (small-cap stocks outperform large-cap stocks) and a value effect (value stocks outperform growth stocks).

Other identified anomalies involve closed-end investment funds selling at a discount to NAV, slow adjustments to earnings surprises, investor overreaction to and long-term underperformance of IPOs, and a relationship between stock returns and prior economic fundamentals.

LOS 38.g

Behavioral finance examines whether investors behave rationally, how investor behavior affects financial markets, and how cognitive biases may result in anomalies. Behavioral finance describes investor irrationality but does not necessarily refute market efficiency as long as investors cannot consistently earn abnormal risk-adjusted returns.

ANSWER KEY FOR MODULE QUIZ

Module Quiz 38.1

1. **B** In informationally efficient capital markets, new information is quickly reflected in security prices. Investors react only to unexpected information releases because information releases that are expected will already be reflected in securities prices. Active strategies will underperform in an efficient market because they have greater transactions and management costs than passive strategies and will not consistently create positive abnormal returns after adjusting for risk. (LOS 38.a)
2. **A** Intrinsic value changes as new information arrives in the marketplace. It cannot be known with certainty and can only be estimated. The price of an asset at a given point in time is its market value, which will differ from its intrinsic value if markets are not fully efficient. (LOS 38.b)
3. **B** Short selling promotes market efficiency because the sales pressure from short selling can reduce the prices of assets that have become overvalued. (LOS 38.c)
4. **A** Weak-form EMH states that stock prices fully reflect all market (i.e., price and volume) information. (LOS 38.d)
5. **B** Tests indicate that mutual fund performance has been inferior to that of a passive index strategy. (LOS 38.e)
6. **C** The majority of evidence is that anomalies are not violations of market efficiency but are due to the research methodologies used. Portfolio management based on anomalies will likely be unprofitable after transactions costs are considered. (LOS 38.f)
7. **C** Loss aversion refers to the tendency of investors to be more risk averse when faced with potential losses and less risk averse when faced with potential gains. That is, they dislike losses more than they like gains of an equal amount. Their risk preferences are asymmetric. (LOS 38.g)

The following is a review of the Equity Investments (2) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #39.

READING 39: OVERVIEW OF EQUITY SECURITIES

Study Session 13

EXAM FOCUS

Equities have higher returns than bonds and bills, but also higher risk. Know the characteristics of common and preferred equity types, as well as the methods of investing in foreign stock. Understand the difference between the book value of equity and market value of equity and what this difference represents.

MODULE 39.1: TYPES OF EQUITY INVESTMENTS



Video covering this content is available online.

LOS 39.a: Describe characteristics of types of equity securities.

CFA[®] Program Curriculum, Volume 4, page 357

Common shares are the most common form of equity and represent an ownership interest. Common shareholders have a residual claim (after the claims of debtholders and preferred stockholders) on firm assets if the firm is liquidated and govern the corporation through voting rights. Firms are under no obligation to pay dividends on common equity; the firm determines what dividend will be paid periodically. Common stockholders are able to vote for the board of directors, on merger decisions, and on the selection of auditors. If they are unable to attend the annual meeting, shareholders can vote by **proxy** (having someone else vote as they direct them, on their behalf).

In a **statutory voting** system, each share held is assigned one vote in the election of each member of the board of directors. Under **cumulative voting**, shareholders can allocate their votes to one or more candidates as they choose. For example, consider a situation where a shareholder has 100 shares and three directors will be elected. Under statutory voting, the shareholder can vote 100 shares for his director choice in each election. Under cumulative voting, the shareholder has 300 votes, which can be cast for a single candidate or spread across multiple candidates. The three receiving the greatest number of votes are elected. Cumulative voting makes it possible for a minority shareholder to have more proportional representation on the board. The way the math works, a holder of 30% of the firm's shares could choose three of ten directors with cumulative voting but could elect no directors under statutory voting.

Preference shares (or **preferred stock**) have features of both common stock and debt. As with common stock, preferred stock dividends are not a contractual obligation, and the shares usually do not mature. Like debt, preferred shares typically make fixed periodic payments to investors and do not usually have voting rights. Preference shares may be callable, giving the firm the right to repurchase the shares at a pre-specified call price. They may also be puttable,

giving the shareholder the right to sell the preference shares back to the issuer at a specified price.

Cumulative preference shares are usually promised fixed dividends, and any dividends that are not paid must be made up before common shareholders can receive dividends. The dividends of **non-cumulative preference shares** do not accumulate over time when they are not paid, but dividends for any period must be paid before common shareholders can receive dividends.

Preferred shares have a stated par value and pay a percentage dividend based on the par value of the shares. An \$80 par value preferred with a 10% dividend pays a dividend of \$8 per year. Investors in **participating preference shares** receive extra dividends if firm profits exceed a predetermined level and may receive a value greater than the par value of the preferred stock if the firm is liquidated. **Non-participating preference shares** have a claim equal to par value in the event of liquidation and do not share in firm profits. Smaller and riskier firms whose investors may be concerned about the firm's future often issue participating preferred stock so investors can share in the upside potential of the firm.

Convertible preference shares can be exchanged for common stock at a conversion ratio determined when the shares are originally issued. It has the following advantages:

- The preferred dividend is higher than a common dividend.
- If the firm is profitable, the investor can share in the profits by converting his shares into common stock.
- The conversion option becomes more valuable when the common stock price increases.
- Preferred shares have less risk than common shares because the dividend is stable and they have priority over common stock in receiving dividends and in the event of liquidation of the firm.

Because of their upside potential, convertible preferred shares are often used to finance risky venture capital and private equity firms. The conversion feature compensates investors for the additional risk they take when investing in such firms.

LOS 39.b: Describe differences in voting rights and other ownership characteristics among different equity classes.

CFA® Program Curriculum, Volume 4, page 358

A firm may have different classes of common stock (e.g., "Class A" and "Class B" shares). One class may have greater voting power and seniority if the firm's assets are liquidated. The classes may also be treated differently with respect to dividends, stock splits, and other transactions with shareholders. Information on the ownership and voting rights of different classes of equity shares can be found in the company's filings with securities regulators, such as the Securities and Exchange Commission in the United States.

LOS 39.c: Distinguish between public and private equity securities.

CFA® Program Curriculum, Volume 4, page 362

The discussion so far has centered on equity that is publicly traded. **Private equity** is usually issued to institutional investors via private placements. Private equity markets are smaller than public markets but are growing rapidly.

Compared to public equity, private equity has the following characteristics:

- Less liquidity because no public market for the shares exists.
- Share price is negotiated between the firm and its investors, not determined in a market.
- More limited firm financial disclosure because there is no government or exchange requirement to do so.
- Lower reporting costs because of less onerous reporting requirements.
- Potentially weaker corporate governance because of reduced reporting requirements and less public scrutiny.
- Greater ability to focus on long-term prospects because there is no public pressure for short-term results.
- Potentially greater return for investors once the firm goes public.

The three main types of private equity investments are venture capital, leveraged buyouts, and private investments in public equity.

Venture capital refers to the capital provided to firms early in their life cycles to fund their development and growth. Venture capital financing at various stages of a firm's development is referred to as *seed* or *start-up*, *early stage*, or *mezzanine* financing. Investors can be family, friends, wealthy individuals, or private equity funds. Venture capital investments are illiquid and investors often have to commit funds for three to ten years before they can cash out (exit) their investment. Investors hope to profit when they can sell their shares after (or as part of) an initial public offering or to an established firm.

In a **leveraged buyout** (LBO), investors buy all of a firm's equity using debt financing (leverage). If the buyers are the firm's current management, the LBO is referred to as a **management buyout** (MBO). Firms in LBOs usually have cash flow that is adequate to service the issued debt or have undervalued assets that can be sold to pay down the debt over time.

In a **private investment in public equity** (PIPE), a public firm that needs capital quickly sells private equity to investors. The firm may have growth opportunities, be in distress, or have large amounts of debt. The investors can often buy the stock at a sizeable discount to its market price.



MODULE QUIZ 39.1

To best evaluate your performance, enter your quiz answers online.

1. The advantage of participating preferred shares versus non-participating preferred shares is that participating preferred shares can:
 - A. obtain voting rights.
 - B. receive extra dividends.
 - C. be converted into common stock.
2. Which of the following *best* describes the benefit of cumulative share voting?
 - A. It provides significant minority shareholders with proportional representation on the board.
 - B. It prevents minority shareholders from exercising excessive control.
 - C. If cumulative dividends are not paid, preferred shareholders are given voting rights.
3. Compared to public equity, which of the following is *least likely* to characterize private equity?
 - A. Lower reporting costs.

- B. Potentially weaker corporate governance.
- C. Lower returns because of its less liquid market.

MODULE 39.2: FOREIGN EQUITIES AND EQUITY RISK



Video covering
this content is
available online.

LOS 39.d: Describe methods for investing in non-domestic equity securities.

CFA® Program Curriculum, Volume 4, page 365

When capital flows freely across borders, markets are said to be *integrated*. The world's financial markets have become more integrated over time, especially as a result of improved communications and trading technologies. However, barriers to global capital flows still exist. Some countries restrict foreign ownership of their domestic stocks, primarily to prevent foreign control of domestic companies and to reduce the variability of capital flows in and out of their countries.

An increasing number of countries have dropped foreign capital restrictions. Studies have shown that reducing capital barriers improves equity market performance. Furthermore, companies are increasingly turning to foreign investors for capital by listing their stocks on foreign stock exchanges or by encouraging foreign ownership of shares.

From the firm's perspective, listing on foreign stock exchanges increases publicity for the firm's products and the liquidity of the firm's shares. Foreign listing also increases firm transparency due to the stricter disclosure requirements of many foreign markets.

Direct investing in the securities of foreign companies simply refers to buying a foreign firm's securities in foreign markets. Some obstacles to direct foreign investment are that:

- The investment and return are denominated in a foreign currency.
- The foreign stock exchange may be illiquid.
- The reporting requirements of foreign stock exchanges may be less strict, impeding analysis.
- Investors must be familiar with the regulations and procedures of each market in which they invest.

Other methods for investing in foreign companies are provided by global depository receipts (GDRs), American depository receipts (ADRs), global registered shares (GRSs), and baskets of listed depository receipts (BLDRs).

Depository receipts (DRs) represent ownership in a foreign firm and are traded in the markets of other countries in local market currencies. A bank deposits shares of the foreign firm and then issues receipts representing ownership of a specific number of the foreign shares. The **depository bank** acts as a custodian and manages dividends, stock splits, and other events. Although the investor does not have to convert to the foreign currency, the value of the DR is affected by exchange rate changes, as well as firm fundamentals, economic events, and any other factors that affect the value of any stock.

If the firm is involved with the issue, the depository receipt is a **sponsored DR**; otherwise, it is an **unsponsored DR**. A sponsored DR provides the investor voting rights and is usually

subject to greater disclosure requirements. In an unsponsored DR, the depository bank retains the voting rights.

Global depository receipts (GDRs) are issued outside the United States and the issuer's home country. Most GDRs are traded on the London and Luxembourg exchanges. Although not listed on U.S. exchanges, they are usually denominated in U.S. dollars and can be sold to U.S. institutional investors. GDRs are not subject to the capital flow restrictions imposed by governments and thus offer the firm and the investor greater opportunities for foreign investment. The firm usually chooses to list the GDR in a market where many investors are familiar with the firm.

American depository receipts (ADRs) are denominated in U.S. dollars and trade in the United States. The security on which the ADR is based is the **American depository share** (ADS), which trades in the firm's domestic market. Some ADRs allow firms to raise capital in the United States or use the shares to acquire other firms. Most require U.S. Securities and Exchange Commission (SEC) registration, but some are privately placed (Rule 144A or Regulation S receipts).

The four types of ADRs, with different levels of trading availability and firm requirements, are summarized in [Figure 39.1](#).

Figure 39.1: Types of ADRs

	Level I	Level II	Level III	Rule 144A
Trading location	Over-the-counter (OTC)	NYSE, Nasdaq, and AMEX	NYSE, Nasdaq, and AMEX	Private
SEC registration required	Yes	Yes	Yes	No
Ability to raise capital in United States	No	No	Yes	Yes
Firm listing expenses	Low	High	High	Low

Global registered shares (GRS) are traded in different currencies on stock exchanges around the world.

A **basket of listed depository receipts** (BLDR) is an exchange-traded fund (ETF) that is a collection of DRs. ETF shares trade in markets just like common stocks.

LOS 39.e: Compare the risk and return characteristics of different types of equity securities.

CFA® Program Curriculum, Volume 4, page 370

The returns on equity investments consist of price changes, dividend payments, and, in the case of equities denominated in a foreign currency, gains or losses from changes in exchange rates. A Japanese investor who invests in euro-denominated shares will have greater yen-based returns if the euro appreciates relative to the yen.

Gains from dividends and the reinvestment of dividends have been an important part of equity investors' long-term returns. For example, \$1 invested in U.S. stocks in 1900 would have been worth \$834 in real terms in 2011 with dividends reinvested but only \$8.10 with price appreciation alone. Over the same time period, the terminal wealth for bonds and bills would have been \$9.30 and \$2.80, respectively.¹

The risk of equity securities is most commonly measured as the standard deviation of returns. Preferred stock is less risky than common stock because preferred stock pays a known, fixed dividend to investors that is a large part of the return, whereas common dividends are variable and can vary with earnings. Also, preferred stockholders receive their distributions before common shareholders and have a claim in liquidation equal to the par value of their shares that has priority over the claims of common stock owners. Because it is less risky, preferred stock has a lower average return than common stock.

Cumulative preferred shares have less risk than non-cumulative preferred shares because they retain the right to receive any missed dividends before any common stock dividends can be paid.

For both common and preferred shares, putable shares are less risky and callable shares are more risky compared to shares with neither option. Putable shares are less risky because if the market price drops, the investor can put the shares back to the firm at a fixed price (assuming the firm has the capital to honor the put). Because of this feature, putable shares usually pay a lower dividend yield than non-putable shares.

Callable shares are the most risky because if the market price rises, the firm can call the shares, limiting the upside potential of the shares. Callable shares, therefore, usually have higher dividend yields than non-callable shares.

LOS 39.f: Explain the role of equity securities in the financing of a company's assets.

CFA® Program Curriculum, Volume 4, page 373

Equity capital is used for the purchase of long-term assets, equipment, research and development, and expansion into new businesses or geographic areas. Equity securities provide the firm with "currency" that can be used to buy other companies or that can be offered to employees as incentive compensation. Having publicly traded equity securities provides liquidity, which may be especially important to firms that need to meet regulatory requirements, capital adequacy ratios, and liquidity ratios.

LOS 39.g: Distinguish between the market value and book value of equity securities.

CFA® Program Curriculum, Volume 4, page 373

The primary goal of firm management is to increase the book value of the firm's equity and thereby increase the market value of its equity. The **book value of equity** is the value of the firm's assets on the balance sheet minus its liabilities. It increases when the firm has positive net income and retained earnings that flow into the equity account. When management makes decisions that increase income and retained earnings, they increase the book value of equity.

The **market value of equity** is the total value of a firm's outstanding equity shares based on market prices and reflects the expectations of investors about the firm's future performance. Investors use their perceptions of the firm's risk and the amounts and timing of future cash flows to determine the market value of equity. The market value and book value of equity are

seldom equal. Although management may be maximizing the book value of equity, this may not be reflected in the market value of equity because book value does not reflect investor expectations about future firm performance.

LOS 39.h: Compare a company's cost of equity, its (accounting) return on equity, and investors' required rates of return.

CFA® Program Curriculum, Volume 4, page 373

A key ratio used to determine management efficiency is the **accounting return on equity**, usually referred to simply as the **return on equity (ROE)**. ROE is calculated as net income available to common (net income minus preferred dividends) divided by the average book value of common equity over the period:

$$ROE_t = \frac{NI_t}{\text{average } BV_t} = \frac{NI_t}{(BV_t + BV_{t-1})/2}$$

Alternatively, ROE is often calculated using only beginning-of-year book value of equity (i.e., book value of equity for end of year $t - 1$):

$$ROE_t = \frac{NI_t}{BV_{t-1}}$$

The first method is more appropriate when it is the industry convention or when book value is volatile. The latter method is more appropriate when examining ROE for a number of years or when book value is stable.

Higher ROE is generally viewed as a positive for a firm, but the reason for an increase should be examined. For example, if book value is decreasing more rapidly than net income, ROE will increase. This is not, however, a positive for the firm. A firm can also issue debt to repurchase equity, thereby decreasing the book value of equity. This would increase the ROE but also make the firm's shares riskier due to the increased financial leverage (debt).



PROFESSOR'S NOTE

The DuPont formula discussed in the topic review of Financial Analysis Techniques can help the analyst determine the reasons for changes in ROE.

The book value of equity reflects a firm's financial decisions and operating results since its inception, whereas the market value of equity reflects the market's consensus view of a firm's future performance. The **price-to-book ratio** (also called the **market-to-book ratio**) is the market value of a firm's equity divided by the book value of its equity. The more optimistic investors are about the firm's future growth, the greater its price-to-book ratio. The price-to-book ratio is used as a measure of relative value. Often, firms with low price-to-book ratios are considered *value stocks*, while firms with high price-to-book ratios are considered *growth stocks*.

EXAMPLE: ROE, market, and book value of equity calculations

Given the following data for O'Grady Industries, calculate the return on average equity for 20X9 and the total market value of equity, the book value per share, and the price-to-book ratio at the end of 20X9.

Fiscal Year-End Dec. 31	20X9	20X8
Total stockholder's equity	18,503	17,143

Net income available to common	3,526	3,056
Stock price	\$16.80	\$15.30
Shares outstanding	3,710	2,790

Answer:

The return on average equity for 20X9 is:

$$\begin{aligned} \text{ROE}_t &= \frac{\text{NI}_t}{\text{average BV}_t} = \frac{\text{NI}_t}{(\text{BV}_t + \text{BV}_{t-1})/2} \\ &= \frac{\$3,526}{(\$18,503 + \$17,143)/2} = 19.78\% \end{aligned}$$

The total market value of the firm's equity at the end of 20X9 is:

$$\$16.80 \times 3,710 = \$62,328$$

The book value per share at the end of 20X9 is:

$$= \frac{\$18,503}{3,710} = \$4.99$$

The price-to-book ratio at the end of 20X9 is:

$$= \frac{\$16.80}{\$4.99} = 3.37$$

Investors' Required Return and the Cost of Equity

A firm's **cost of equity** is the expected equilibrium total return (including dividends) on its shares in the market. It is usually estimated in practice using a dividend discount model or the capital asset pricing model. At any point in time, a decrease in share price will increase the expected return on the shares and an increase in share price will decrease expected returns, other things equal. Because the intrinsic value of a firm's shares is the discounted present value of its future cash flows, an increase (decrease) in the required return used to discount future cash flows will decrease (increase) intrinsic value.

Investors also estimate the expected market returns on equity shares and compare this to the minimum return they will accept for bearing the risk inherent in a particular stock.

If an investor estimates the expected return on a stock to be greater than her minimum required rate of return on the shares, given their risk, then the shares are an attractive investment. Investors can have different required rates of return for a given risk, different estimates of a firm's future cash flows, and different estimates of the risk of a firm's equity shares. A firm's cost of equity can be interpreted as the minimum rate of return required by investors (in the aggregate) to compensate them for the risk of the firm's equity shares.



MODULE QUIZ 39.2

To best evaluate your performance, enter your quiz answers online.

- Global depository receipts are most often denominated in:
 - the currency of the country where they trade and issued outside the United States.
 - U.S. dollars and issued in the United States.
 - U.S. dollars and issued outside the United States.
- Which of the following types of preferred shares has the *most* risk for investors?

- A. Puttable shares.
 - B. Callable shares.
 - C. Non-puttable, non-callable shares.
3. Which of the following *best* describes the book value of equity?
- A. Management should attempt to maximize book value of equity.
 - B. Book value of equity decreases when retained earnings increase.
 - C. Book value of equity reflects investors' perceptions of the firm's future.
4. Which of the following causes of an increase in return on equity is *most likely* a positive sign for a firm's equity investors?
- A. A firm issues debt to repurchase equity.
 - B. Net income is increasing at a faster rate than book value of equity.
 - C. Net income is decreasing at a slower rate than book value of equity.

KEY CONCEPTS

LOS 39.a

Common shareholders have a residual claim on firm assets and govern the corporation through voting rights. Common shares have variable dividends which the firm is under no legal obligation to pay.

Callable common shares allow the firm the right to repurchase the shares at a pre-specified price. Puttable common shares give the shareholder the right to sell the shares back to the firm at a pre-specified price.

Preferred stock typically does not mature, does not have voting rights, and has dividends that are fixed in amount but are not a contractual obligation of the firm.

Cumulative preferred shares require any dividends that were missed in the past (dividends in arrears) to be paid before common shareholders receive any dividends. Participating preferred shares receive extra dividends if firm profits exceed a pre-specified level and a value greater than the par value if the firm is liquidated. Convertible preferred stock can be converted to common stock at a pre-specified conversion ratio.

LOS 39.b

Some companies' equity shares are divided into different classes, such as Class A and Class B shares. Different classes of common equity may have different voting rights and priority in liquidation.

LOS 39.c

Compared to publicly traded firms, private equity firms have lower reporting costs, greater ability to focus on long-term prospects, and potentially greater return for investors once the firm goes public. However, private equity investments are illiquid, firm financial disclosure may be limited, and corporate governance may be weaker.

LOS 39.d

Investors who buy foreign stock directly on a foreign stock exchange receive a return denominated in a foreign currency, must abide by the foreign stock exchange's regulations and procedures, and may be faced with less liquidity and less transparency than is available in the investor's domestic markets. Investors can often avoid these disadvantages by purchasing depository receipts for the foreign stock that trade on their domestic exchange.

Global depository receipts are issued outside the United States and outside the issuer's home country. American depository receipts are denominated in U.S. dollars and are traded on U.S. exchanges.

Global registered shares are common shares of a firm that trade in different currencies on stock exchanges throughout the world.

Baskets of listed depository receipts are exchange-traded funds that invest in depository receipts.

LOS 39.e

Equity investor returns consist of dividends, capital gains or losses from changes in share prices, and any foreign exchange gains or losses on shares traded in a foreign currency. Compounding of reinvested dividends has been an important part of an equity investor's long-term return.

Preferred stock is less risky than common stock because preferred stock pays a known, fixed dividend to investors; preferred stockholders must receive dividends before common stock dividends can be paid; and preferred stockholders have a claim equal to par value if the firm is liquidated. Puttable shares are the least risky and callable shares are the most risky. Cumulative preferred shares are less risky than non-cumulative preferred shares, as any dividends missed must be paid before a common stock dividend can be paid.

LOS 39.f

Equity securities provide funds to the firm to buy productive assets, to buy other companies, or to offer to employees as compensation. Equity securities provide liquidity that may be important when the firm must raise additional funds.

LOS 39.g

The book value of equity is the difference between the financial statement value of the firm's assets and liabilities. Positive retained earnings increase the book value of equity. Book values reflect the firm's past operating and financing choices.

The market value of equity is the share price multiplied by the number of shares outstanding. Market value reflects investors' expectations about the timing, amount, and risk of the firm's future cash flows.

LOS 39.h

The accounting return on equity (ROE) is calculated as the firm's net income divided by the book value of common equity. ROE measures whether management is generating a return on common equity but is affected by the firm's accounting methods.

The firm's cost of equity is the minimum rate of return that investors in the firm's equity require. Investors' required rates of return are reflected in the market prices of the firm's shares.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 39.1

1. **B** Participating preferred shares can receive extra dividends if firm profits exceed a pre-specified level and a value greater than the par value if the firm is liquidated. (LOS 39.a)
2. **A** Cumulative voting allows minority shareholders to gain representation on the board because they can use all of their votes for specific board members. (LOS 39.b)
3. **C** Private equity has less liquidity because no public market for it exists. The lower liquidity of private equity would increase required returns. (LOS 39.c)

Module Quiz 39.2

1. **C** Global Depository Receipts are not listed on U.S. exchanges and are most often denominated in U.S. dollars. They are not issued in the United States. (LOS 39.d)
2. **B** Callable shares are the most risky because if the market price rises, the firm can call in the shares, limiting the investor's potential gains. Puttable shares are the least risky because if the market price drops, the investor can put the shares back to the firm at a predetermined price. The risk of non-puttable, non-callable shares falls in between. (LOS 39.e)
3. **A** The primary goal of firm management is to increase the book value of equity. It increases when retained earnings are positive. The *market* value of equity reflects the collective expectations of investors about the firm's future performance. (LOS 39.g)
4. **B** Net income increasing at a faster rate than book value of equity generally would be a positive sign. If a firm issues debt to repurchase equity, this decreases the book value of equity and increases the ROE. However, now the firm becomes riskier due to the increased debt. Net income decreasing at a slower rate than book value of equity would increase ROE, but decreasing net income is not a positive sign. (LOS 39.h)

1. Ryan C. Fuhrmann, CFA, and Asjeet S. Lamba, CFA, *Overview of Equity Securities*, CFA Program Level I 2020 Curriculum, Volume 5 (CFA Institute, 2019).

The following is a review of the Equity Investments (2) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #40.

READING 40: INTRODUCTION TO INDUSTRY AND COMPANY ANALYSIS

Study Session 13

EXAM FOCUS

This topic provides a great deal of material on industry analysis. Understand the effects of business cycles and the stage of an industry's life cycle. Porter's five forces and two competitive strategies are very important to know. Beyond these, make sure that you know the effects on price competition and profitability of the items considered in industry analysis and of the various firm characteristics discussed.

MODULE 40.1: INDUSTRY ANALYSIS



LOS 40.a: Explain uses of industry analysis and the relation of industry analysis to company analysis.

Video covering this content is available online.

CFA[®] Program Curriculum, Volume 4, page 388

Industry analysis is important for company analysis because it provides a framework for understanding the firm. Analysts will often focus on a group of specific industries so that they can better understand the business conditions the firms in those industries face.

Understanding a firm's business environment can provide insight about the firm's potential growth, competition, and risks. For a credit analyst, industry conditions can provide important information about whether a firm will be able to meet its obligations during the next recession.

In an active management strategy, industry analysis can identify industries that are undervalued or overvalued in order to weight them appropriately. Some investors engage in **industry rotation**, which is overweighting or underweighting industries based on the current phase of the business cycle. A firm's industry has been found to be as important as its home country in determining its performance.

In performance attribution analysis, the sources of portfolio return are determined relative to a benchmark. The industry representation within a portfolio is often a significant component of attribution analysis.

LOS 40.b: Compare methods by which companies can be grouped, current industry classification systems, and classify a company, given a description of its activities and the classification system.

CFA[®] Program Curriculum, Volume 4, page 389

One way to group companies into an industry is by the *products and services* they offer. For example, the firms that produce automobiles constitute the auto industry. A **sector** is a group

of similar industries. Hospitals, doctors, pharmaceutical firms, and other industries are included in the health care sector. Systems that are grouped by products and services usually use a firm's **principal business activity** (the largest source of sales or earnings) to classify firms. Examples of these systems are discussed in the following and include the Global Industry Classification Standard (GICS), Russell Global Sectors (RGS), and Industry Classification Benchmark.

Firms can also be classified by their *sensitivity to business cycles*. This system has two main classifications: cyclical and non-cyclical firms.

Statistical methods, such as cluster analysis, can also be used. This method groups firms that historically have had highly correlated returns. The groups (i.e., industries) formed will then have lower returns correlations between groups.

This method has several limitations:

- Historical correlations may not be the same as future correlations.
- The groupings of firms may differ over time and across countries.
- The grouping of firms is sometimes non-intuitive.
- The method is susceptible to statistical error (i.e., firms can be grouped by a relationship that occurs by chance, or not grouped together when they should be).

Industry Classification Systems

Classifying firms by industry provides a method of examining trends and firm valuations. It also allows analysts to compare firms in different countries on a similar basis. The following are the industry classification systems currently available to investors.

Commercial classifications

Several index providers classify firms. Some use three levels of classification, while others use four levels. The providers generally use firm fundamentals such as revenue to classify firms. Although the nomenclature differs among providers, the broadest category is generally the sector level, followed by industry and sub-industry.

Commercial industry classifications include the Global Industry Classification Standard developed by Standard & Poor's and MSCI Barra, Russell Global Sectors, and the Industry Classification Benchmark developed by Dow Jones and FTSE.

Sectors and firm compositions representative of those used by commercial providers are as follows.

Basic materials and processing firms produce:

- Building materials.
- Chemicals.
- Paper and forest products.
- Containers and packaging.
- Metals, minerals, and mining.

Consumer discretionary firms are cyclical and sell goods and services in industries such as:

- Automotive.
- Apparel.
- Hotels and restaurants.

Consumer staples firms are less cyclical and sell goods and services in industries such as:

- Food.
- Beverage.
- Tobacco.
- Personal care products.

Energy firms are involved in:

- Energy exploration.
- Refining.
- Production.
- Energy equipment.
- Energy services.

Financial services firms include firms involved in:

- Banking.
- Insurance.
- Real estate financing.
- Asset management.
- Brokerage.

Health care includes:

- Pharmaceuticals.
- Biotech.
- Medical devices.
- Health care equipment.
- Medical supplies.
- Health care services.

Industrial and producer durables firms produce capital goods for commercial services industries including:

- Heavy machinery and equipment.
- Aerospace.
- Defense.
- Transportation.
- Commercial services and supplies.

Real estate firms are involved in the development, management, and operation of real properties, including:

- Real estate investment trusts (REITs).
- Real estate services firms.

Technology firms sell or produce:

- Computers.
- Software.
- Semiconductors.
- Communications equipment.
- Internet services.
- Electronic entertainment.
- Consulting and services.

Telecommunications firms include wired and wireless service providers. *Utilities* includes electric, gas, and water utilities. Some industry classification providers include telecommunication and utilities in the same group, while others separate them.

To classify a firm accurately, an analyst should have detailed knowledge about the firm and the delineation of industry classifications.

Government classifications

Several government bodies also provide industry classification of firms. They frequently do so to organize the economic data they publish. A main thrust of their systems is to make comparisons of industries consistent across time and country. The main systems are similar to each other.

- *International Standard Industrial Classification of All Economic Activities* (ISIC) was produced by the United Nations in 1948 to increase global comparability of data.
- *Statistical Classification of Economic Activities in the European Community* is similar to the ISIC but is designed for Europe.
- *Australian and New Zealand Standard Industrial Classification* was jointly developed by those countries.
- *North American Industry Classification System* (NAICS) was jointly developed by the United States, Canada, and Mexico.

The methodologies that government providers use in their compilation of industry groups differ from those used by commercial providers. Most governments do not identify individual firms in a group, so an analyst cannot know the groups' exact composition. Commercial providers identify the constituent firms. Government systems are updated less frequently; for example, the NAICS is updated every five years. Governments do not distinguish between small and large firms, for-profit and not-for-profit organizations, or private and public firms. Commercial providers only include for-profit and public firms and can delineate by the size of the firm.

An analyst should not assume that two firms in the same narrowest industry classification can be compared with each other for fundamental analysis and valuation. Instead, the analyst should construct *peer groups*, as described later in this topic review.

LOS 40.c: Explain the factors that affect the sensitivity of a company to the business cycle and the uses and limitations of industry and company descriptors such as “growth,” “defensive,” and “cyclical.”

CFA® Program Curriculum, Volume 4, page 390

A **cyclical firm** is one whose earnings are highly dependent on the stage of the business cycle. These firms have high earnings volatility and high operating leverage. Their products are often expensive, non-necessities whose purchase can be delayed until the economy improves. Examples of cyclical industries include basic materials and processing, consumer discretionary, energy, financial services, industrial and producer durables, and technology.

In contrast, a **non-cyclical firm** produces goods and services for which demand is relatively stable over the business cycle. Examples of non-cyclical industries include health care, utilities, telecommunications, and consumer staples.

Sectors can also be classified by their sensitivity to the phase of the business cycle. Cyclical sector examples include energy, financials, technology, materials, and consumer discretionary. Non-cyclical sector examples include health care, utilities, and consumer staples.

Non-cyclical industries can be further separated into defensive (stable) or growth industries. **Defensive industries** are those that are least affected by the stage of the business cycle and include utilities, consumer staples (such as food producers), and basic services (such as drug stores). **Growth industries** have demand so strong they are largely unaffected by the stage of the business cycle.

Descriptors such as “growth,” “defensive,” and “cyclical” should be used with caution. The term **growth cyclical** is used to describe firms with strong long-term growth potential that have revenue that is quite sensitive to economic cycles. Cyclical industries, which are supposed to be dependent on the business cycle, often include growth firms that are less dependent on the business cycle. Non-cyclical industries can be affected by severe recessions, as was the case in the 2008–09 downturn. Defensive industries may not always be safe investments. For example, grocery stores are classified as defensive, but they are subject to intense price competition that reduces earnings. Defensive industries may also contain some truly defensive and some growth firms. Because business cycle phases differ across countries and regions, two cyclical firms operating in different countries may be simultaneously experiencing different cyclical effects on earnings growth.

LOS 40.d: Explain how a company’s industry classification can be used to identify a potential “peer group” for equity valuation.

CFA® Program Curriculum, Volume 4, page 398

A **peer group** is a set of similar companies an analyst will use for valuation comparisons. More specifically, a peer group will consist of companies with similar business activities, demand drivers, cost structure drivers, and availability of capital.

To form a peer group, an analyst will often start by identifying companies in the same industry classification, using the commercial classification providers previously described. Usually, the analyst will use other information to verify that the firms in an industry are indeed peers. An analyst might include a company in more than one peer group.

The following are steps an analyst would use to form a peer group:

- Use commercial classification providers to determine which firms are in the same industry.
- Examine firms' annual reports to see if they identify key competitors.
- Examine competitors' annual reports to see if other competitors are named.
- Use industry trade publications to identify competitors.
- Confirm that comparable firms have similar sources of sales and earnings, have similar sources of demand, and are in similar geographic markets.
- Adjust financial statements of non-financial companies for any financing subsidiary data they include.

LOS 40.e: Describe the elements that need to be covered in a thorough industry analysis.

CFA® Program Curriculum, Volume 4, page 402

A thorough industry analysis should include the following elements:

- Evaluate the relationships between macroeconomic variables and industry trends using information from industry groups, firms in the industry, competitors, suppliers, and customers.
- Estimate industry variables using different approaches and scenarios.
- Compare with other analysts' forecasts of industry variables to confirm the validity of the analysis and potentially find industries that are misvalued as a result of consensus forecasts.
- Determine the relative valuation of different industries.
- Compare the valuations of industries across time to determine the volatility of their performance over the long run and during different phases of the business cycle. This is useful for long-term investing as well as short-term industry rotation based on the current economic environment.
- Analyze industry prospects based on **strategic groups**, which are groups of firms that are distinct from the rest of the industry due to the delivery or complexity of their products or barriers to entry. For example, full-service hotels are a distinct market segment within the hotel industry.
- Classify industries by **life-cycle stage**, whether it is embryonic, growth, shakeout, mature, or declining.
- Position the industry on the **experience curve**, which shows the cost per unit relative to output. The curve declines because of increases in productivity and economies of scale, especially in industries with high fixed costs.
- Consider the forces that affect industries, which include demographic, macroeconomic, governmental, social, and technological influences.
- Examine the forces that determine competition within an industry.

LOS 40.f: Describe the principles of strategic analysis of an industry.

CFA® Program Curriculum, Volume 4, page 404

Industries differ markedly in profitability because of differences in economic fundamentals, industry structure, and degree of competition. In some industries, competition is intense and few firms earn economic profits. **Economic profits**, the return on invested capital minus its cost, are greater than 20% in some industries and negative in others. The degree of economic profits depends in part on pricing power (elasticity of demand for the firm's products). An analyst should understand that industry conditions and profits can change dramatically over time, so industry analysis should be forward-looking.

One component of an analyst's industry analysis should be **strategic analysis**, which examines how an industry's competitive environment influences a firm's strategy. The analysis framework developed by Michael Porter¹ delineates five forces that determine industry competition.

1. *Rivalry among existing competitors.* Rivalry increases when many firms of relatively equal size compete within an industry. Slow growth leads to competition as firms fight for market share, and high fixed costs lead to price decreases as firms try to operate at full capacity. For example, the high fixed costs in the auto industry from capital investments and labor contracts force firms to produce a large number of vehicles that they can only sell at low margins. Industries with products that are undifferentiated or have barriers (are costly) to exit tend to have high levels of competition.
2. *Threat of entry.* Industries that have significant barriers to entry (e.g., large capital outlays for facilities) will find it easier to maintain premium pricing. It is costly to enter the steel or oil production industries. Those industries have large barriers to entry and thus less competition from newcomers. An analyst should identify factors that discourage new entrants, such as economies of scale.
3. *Threat of substitutes.* Substitute products limit the profit potential of an industry because they limit the prices firms can charge by increasing the elasticity of demand. Commodity-like products have high levels of competition and low profit margins. The more differentiated the products are within an industry, the less price competition there will be. For example, in the pharmaceutical industry, patents protect a producer from competition in the markets for patented drugs.
4. *Power of buyers.* Buyers' ability to bargain for lower prices or higher quality influences industry profitability. Bargaining by governments and ever-larger health care providers have put downward pressure even on patented drugs.
5. *Power of suppliers.* Suppliers' ability to raise prices or limit supply influences industry profitability. Suppliers are more powerful if there are just a few of them and their products are scarce. For example, Microsoft is one of the few suppliers of operating system software and thus has pricing power.

The first two forces deserve further attention because almost all firms must be concerned about the threat of new entrants and competition that would erode profits. Studying these forces also helps the analyst better understand the subject firm's competitors and prospects. The following summary describes how these two factors influence the competitive environment in an industry:

- Higher barriers to entry reduce competition.
- Greater concentration (a small number of firms control a large part of the market) reduces competition, whereas market fragmentation (a large number of firms, each with a small market share) increases competition.

- Unused capacity in an industry, especially if prolonged, results in intense price competition. For example, underutilized capacity in the auto industry has resulted in very competitive pricing.
- Stability in market share reduces competition. For example, loyalty of a firm's customers tends to stabilize market share and profits.
- More price sensitivity in customer buying decisions results in greater competition.
- Greater maturity of an industry results in slowing growth.



MODULE QUIZ 40.1

To best evaluate your performance, enter your quiz answers online.

1. Industry classification systems from commercial index providers typically classify firms by:
 - A. statistical methods.
 - B. products and services.
 - C. business cycle sensitivity.
2. Firms and industries are *most appropriately* classified as cyclical or non-cyclical based on:
 - A. their stock price fluctuations relative to the market.
 - B. the sensitivity of their earnings to the business cycle.
 - C. the volatility of their earnings relative to a peer group.
3. An analyst should *most likely* include two firms in the same peer group for analysis if the firms:
 - A. are both grouped in the same industry classification.
 - B. are similar in size, industry life-cycle stage, and cyclicalities.
 - C. derive their revenue and earnings from similar business activities.
4. The industry experience curve shows the cost per unit relative to:
 - A. output.
 - B. age of firms.
 - C. industry life-cycle stage.
5. Which of the following is *least likely* an element of an industry strategic analysis?
 - A. Market correlations.
 - B. Demographic influences.
 - C. Influence of industry capacity on pricing.
6. Two of the five competitive forces in the Porter framework are:
 - A. threat of entry and barriers to exit.
 - B. power of suppliers and threat of substitutes.
 - C. rivalry among competitors and power of regulators.

MODULE 40.2: PRICING POWER AND COMPANY ANALYSIS



Video covering this content is available online.

LOS 40.g: Explain the effects of barriers to entry, industry concentration, industry capacity, and market share stability on pricing power and price competition.

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Barriers to Entry

High barriers to entry benefit existing industry firms because they prevent new competitors from competing for market share and reducing the existing firms' return on capital. In industries with low barriers to entry, firms have little pricing power and competition reduces existing firms' return on capital. To assess the ease of entry, the analyst should determine

how easily a new entrant to the industry could obtain the capital, intellectual property, and customer base needed to be successful. One method of determining the ease of entry is to examine the composition of the industry over time. If the same firms dominate the industry today as ten years ago, entry is probably difficult.

High barriers to entry do not necessarily mean firm pricing power is high. Industries with high barriers to entry may have strong price competition among existing firms. This is more likely when the products sold are undifferentiated and commodity-like or when high barriers to exit result in overcapacity. For example, an automobile factory may have a low value in an alternative use, making firm owners less likely to exit the industry. They continue to operate even when losing money, hoping to turn things around, which can result in industry overcapacity and intense price competition.

Low barriers to entry do not ensure success for new entrants. Barriers to entry may change over time, and so might the competitive environment.

Industry Concentration

High industry concentration does not guarantee pricing power.

- Absolute market share may not matter as much as a firm's market share relative to its competitors. A firm may have a 50% market share, but if a single competitor has the other 50%, their 50% share would not result in a great degree of pricing power. Return on capital is limited by intense competition between the two firms.
- Conversely, a firm that has a 10% market share when no competitor has more than 2% may have a good degree of pricing power and high return on capital.
- If industry products are undifferentiated and commodity-like, then consumers will switch to the lowest-priced producer. The more importance consumers place on price, the greater the competition in an industry. Greater competition leads to lower return on capital.
- Industries with greater product differentiation in regard to features, reliability, and service after the sale will have greater pricing power. Return on capital can be higher for firms that can better differentiate their products.
- If the industry is capital intensive, and therefore costly to enter or exit, overcapacity can result in intense price competition.

Tobacco, alcohol, and confections are examples of highly concentrated industries in which firms' pricing power is relatively strong. Automobiles, aircraft, and oil refining are examples of highly concentrated industries with relatively weak pricing power.

Although industry concentration does not guarantee pricing power, a fragmented market does usually result in strong competition. When there are many industry members, firms cannot coordinate pricing, firms will act independently, and because each member has such a small market share, any incremental increase in market share may make a price decrease profitable.

Industry Capacity

Industry capacity has a clear impact on pricing power. Undercapacity, a situation in which demand exceeds supply at current prices, results in pricing power and higher return on capital. Overcapacity, with supply greater than demand at current prices, will result in downward pressure on price and lower return on capital.

An analyst should be familiar with the industry's current capacity and its planned investment in additional capacity. Capacity is fixed in the short run and variable in the long run. In other words, given enough time, producers will build enough factories and raise enough capital to meet demand at a price close to minimum average cost. However, producers may overshoot the optimal industry capacity, especially in cyclical markets. For example, producers may start to order new equipment during an economic expansion to increase capacity. By the time they bring the additional production on to the market, the economy may be in a recession with decreased demand. A diligent analyst can look for signs that the planned capacity increases of all producers (who may not take into account the capacity increases of other firms) sum to more output than industry demand will support.

Capacity is not necessarily physical. For example, an increase in demand for insurance can be more easily and quickly met than an increase in demand for a product requiring physical capacity, such as electricity or refined petroleum products.

If capacity is physical and specialized, overcapacity can exist for an extended period if producers expand too much over the course of a business cycle. Specialized physical capacity may have a low liquidation value and be costly to reallocate to a different product. Non-physical capacity (e.g., financial capital) can be reallocated more quickly to new industries than physical capacity.

Market Share Stability

An analyst should examine whether firms' market shares in an industry have been stable over time. Market shares that are highly variable likely indicate a highly competitive industry in which firms have little pricing power. More stable market shares likely indicate less intense competition in the industry.

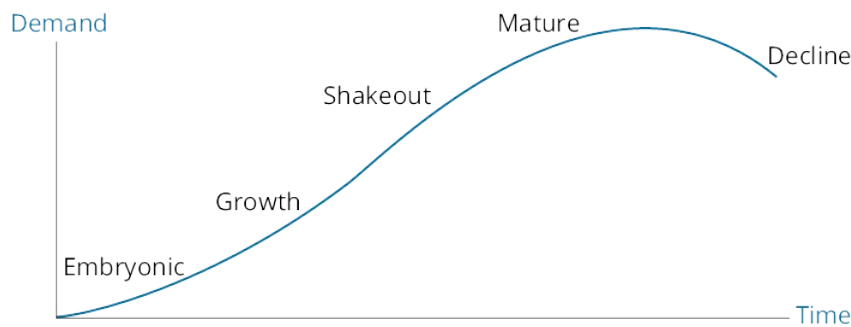
Factors that affect market share stability include barriers to entry, introductions of new products and innovations, and the **switching costs** that customers face when changing from one firm's products to another. Switching costs, such as the time and expense of learning to use a competitor's product, tend to be higher for specialized or differentiated products. High switching costs contribute to market share stability and pricing power.

LOS 40.h: Describe industry life cycle models, classify an industry as to life cycle stage, and describe limitations of the life-cycle concept in forecasting industry performance.

CFA® Program Curriculum, Volume 4, page 414

Industry life cycle analysis should be a component of an analyst's strategic analysis. An industry's stage in the cycle has an impact on industry competition, growth, and profits. An industry's stage will change over time, so the analyst must monitor the industry on an ongoing basis. The five phases of the industry life-cycle model are illustrated in [Figure 40.1](#).

Figure 40.1: Stages of the Industry Life Cycle



In the **embryonic stage**, the industry has just started. The characteristics of this stage are as follows:

- *Slow growth*: customers are unfamiliar with the product.
- *High prices*: the volume necessary for economies of scale has not been reached.
- *Large investment required*: to develop the product.
- *High risk of failure*: most embryonic firms fail.

In the **growth stage**, industry growth is rapid. The characteristics of this stage are as follows:

- *Rapid growth*: new consumers discover the product.
- *Limited competitive pressures*: the threat of new firms coming into the market peaks during the growth phase, but rapid growth allows firms to grow without competing on price.
- *Falling prices*: economies of scale are reached and distribution channels increase.
- *Increasing profitability*: due to economies of scale.

In the **shakeout stage**, industry growth and profitability are slowing due to strong competition. The characteristics of this stage are as follows:

- *Growth has slowed*: demand reaches saturation level with few new customers to be found.
- *Intense competition*: industry growth has slowed, so firm growth must come at the expense of competitors.
- *Increasing industry overcapacity*: firm investment exceeds increases in demand.
- *Declining profitability*: due to overcapacity.
- *Increased cost cutting*: firms restructure to survive and attempt to build brand loyalty.
- *Increased failures*: weaker firms liquidate or are acquired.

In the **mature stage**, there is little industry growth and firms begin to consolidate. The characteristics of this stage are as follows:

- *Slow growth*: market is saturated and demand is only for replacement.
- *Consolidation*: market evolves to an oligopoly.
- *High barriers to entry*: surviving firms have brand loyalty and low cost structures.
- *Stable pricing*: firms try to avoid price wars, although periodic price wars may occur during recessions.

- *Superior firms gain market share*: the firms with better products may grow faster than the industry average.

In the **decline stage**, industry growth is negative. The characteristics of this stage are as follows:

- *Negative growth*: due to development of substitute products, societal changes, or global competition.
- *Declining prices*: competition is intense and there are price wars due to overcapacity.
- *Consolidation*: failing firms exit or merge.

An analyst should determine whether a firm is “acting its age” or stage of industry development. Growth firms should be reinvesting in operations in an attempt to increase product offerings, increase economies of scale, and build brand loyalty. They are not yet worried about cost efficiency. They should not pay out cash flows to investors but save them for internal growth. On the other hand, mature firms focus on cost efficiency because demand is largely from replacement. They find few opportunities to introduce new products. These firms should typically pay out cash to investors as dividends or stock repurchases because cash flows are strong but internal growth is limited. An analyst should be concerned about firms that do not act their stage, such as a mature firm that is investing in low-return projects for the sake of increasing firm size.

Although life-cycle analysis is a useful tool, industries do not always conform to its framework. Life-cycle stages may not be as long or short as anticipated, or they might be skipped altogether. An industry’s product may become obsolete quickly due to technological change, government regulation, societal change, or demographics. Life-cycle analysis is likely most useful during stable periods, not during periods of upheaval when conditions are changing rapidly. Furthermore, some firms will experience growth and profits that are dissimilar to others in their industries due to competitive advantages or disadvantages.

LOS 40.i: Compare characteristics of representative industries from the various economic sectors.

CFA® Program Curriculum, Volume 4, page 420

To illustrate the long list of factors to be considered in industry analysis, we use the following strategic analysis of the candy/confections industry.

- *Major firms*: Cadbury, Hershey, Mars, and Nestle.
- *Barriers to entry and success*: Very high. Low capital and technological barriers, but consumers have strong brand loyalty.
- *Industry concentration*: Very concentrated. Largest four firms dominate global market share.
- *Influence of industry capacity on pricing*: None. Pricing is determined by strength of brand, not production capacity.
- *Industry stability*: Very stable. Market share changes slowly.
- *Life cycle*: Very mature. Growth is driven by population changes.
- *Competition*: Low. Lack of unbranded candy makers in market reduces competition. Consumer decision is based on brand awareness, not price.
- *Demographic influences*: Not applicable.

- *Government influence*: Low. Industry is largely unregulated, but regulation arising from concerns about obesity is possible.
- *Social influence*: Not applicable.
- *Technological influence*: Very low. Limited impact from technology.
- *Business cycle sensitivity*: Non-cyclical and defensive. Demand for candy is very stable.

LOS 40.j: Describe macroeconomic, technological, demographic, governmental, and social influences on industry growth, profitability, and risk.

CFA® Program Curriculum, Volume 4, page 422

The external influences on industry growth, profitability, and risk should be a component of an analyst's strategic analysis. These external factors include macroeconomic, technological, demographic, governmental, and social influences.

Macroeconomic factors can be cyclical or structural (longer-term) trends, most notably economic output as measured by GDP or some other measure. Interest rates affect financing costs for firms and individuals, as well as financial institution profitability. Credit availability affects consumer and business expenditures and funding. Inflation affects costs, prices, interest rates, and business and consumer confidence. An example of a structural economic factor is the education level of the work force. More education can increase workers' productivity and real wages, which in turn can increase their demand for consumer goods.

Technology can change an industry dramatically through the introduction of new or improved products. Computer hardware is an example of an industry that has undergone dramatic transformation. Radical improvements in circuitry were assisted by transformations in other industries, including the computer software and telecommunications industries. Another example of an industry that has been changed by technology is photography, which has largely moved from film to digital media.

Demographic factors include age distribution and population size, as well as other changes in the composition of the population. As a large segment of the population reaches their twenties, residential construction, furniture, and related industries see increased demand. An aging of the overall population can mean significant growth for the health care industry and developers of retirement communities. For example, the aging of the post-World War II Baby Boomers is an example of demographics that will increase demand in these industries.

Governments have an important and widespread effect on businesses through various channels, including taxes and regulation. The level of tax rates certainly affects industries, but analysts should also be aware of the differential taxation applied to some goods. For example, tobacco is heavily taxed in the United States. Specific regulations apply to many industries. Entry into the health care industry, for example, is controlled by governments that license doctors and other providers. Governments can also empower self-regulatory organizations, such as stock exchanges that regulate their members. Some industries, such as the U.S. defense industry, depend heavily on government purchases of goods and services.

Social influences relate to how people work, play, spend their money, and conduct their lives; these factors can have a large impact on industries. For example, when women entered the U.S. workforce, the restaurant industry benefitted because there was less cooking at home. Child care, women's clothing, and other industries were also dramatically affected.

LOS 40.k: Describe the elements that should be covered in a thorough company analysis.

CFA® Program Curriculum, Volume 4, page 429

Having gained understanding of an industry's external environment, an analyst can then focus on **company analysis**. This involves analyzing the firm's financial condition, products and services, and **competitive strategy**. Competitive strategy is how a firm responds to the opportunities and threats of the external environment. The strategy may be defensive or offensive.

Porter has identified two important competitive strategies that can be employed by firms within an industry: a **cost leadership (low-cost) strategy** or a **product or service differentiation strategy**. According to Porter, a firm must decide to focus on one of these two areas to compete effectively.

In a *low-cost strategy*, the firm seeks to have the lowest costs of production in its industry, offer the lowest prices, and generate enough volume to make a superior return. The strategy can be used defensively to protect market share or offensively to gain market share. If industry competition is intense, pricing can be aggressive or even predatory. In **predatory pricing**, the firm hopes to drive out competitors and later increase prices. Although there are often laws prohibiting predatory pricing, it can be hard to prove if the firm's costs are not easily traced to a particular product. A low-cost strategy firm should have managerial incentives that are geared toward improving operating efficiency.

In a *differentiation strategy*, the firm's products and services should be distinctive in terms of type, quality, or delivery. For success, the firm's cost of differentiation must be less than the price premium buyers place on product differentiation. The price premium should also be sustainable over time. Successful differentiators will have outstanding marketing research teams and creative personnel.

A company analysis should include the following elements:

- Firm overview, including information on operations, governance, and strengths and weaknesses.
- Industry characteristics.
- Product demand.
- Product costs.
- Pricing environment.
- Financial ratios, with comparisons to other firms and over time.
- Projected financial statements and firm valuation.

A firm's return on equity (ROE) should be part of the financial analysis. The ROE is a function of profitability, total asset turnover, and financial leverage (debt).



PROFESSOR'S NOTE

The DuPont formula discussed in the topic review of Financial Analysis Techniques can help an analyst understand what drives ROE.

Analysts often use **spreadsheet modeling** to analyze and forecast company fundamentals. The problem with this method is that the models' complexity can make their conclusions

seem precise. However, estimation is performed with error that can compound over time. As a check on a spreadsheet model's output, an analyst should consider which factors are likely to be different going forward and how this will affect the firm. Analysts should also be able to explain the assumptions of a spreadsheet model.



MODULE QUIZ 40.2

To best evaluate your performance, enter your quiz answers online.

1. Greater pricing power is *most likely* to result from greater:
 - A. unused capacity.
 - B. market concentration.
 - C. volatility in market share.
2. Which of the following statements *best* describes the relationship between pricing power and ease of entry and exit? Greater ease of entry:
 - A. and greater ease of exit decrease pricing power.
 - B. and greater ease of exit increase pricing power.
 - C. decreases pricing power and greater ease of exit increases pricing power.
3. Industry overcapacity and increased cost cutting characterize which stage of the industry life cycle?
 - A. Growth.
 - B. Shakeout.
 - C. Maturity.
4. In which of these characteristics is the oil producing industry *most likely* similar to the home building industry?
 - A. Industry concentration.
 - B. Demographic influences.
 - C. Business cycle sensitivity.
5. Which of the following is *least likely* a significant external influence on industry growth?
 - A. Social influences.
 - B. Macroeconomic factors.
 - C. Supplier bargaining power.
6. Which of the following *best* describes a low-cost competitive strategy?
 - A. Volume sold is typically modest.
 - B. Managerial incentives promote operational efficiency.
 - C. Success depends heavily on creative marketing and product development.

KEY CONCEPTS

LOS 40.a

Industry analysis is necessary for understanding a company's business environment before engaging in analysis of the company. The industry environment can provide information about the firm's potential growth, competition, risks, appropriate debt levels, and credit risk.

Industry valuation can be used in an active management strategy to determine which industries to overweight or underweight in a portfolio.

Industry representation is often a component in a performance attribution analysis of a portfolio's return.

LOS 40.b

Firms can be grouped into industries according to their products and services or business cycle sensitivity, or through statistical methods that group firms with high historical correlation in returns.

Industry classification systems from commercial providers include the Global Industry Classification Standard (Standard & Poor's and MSCI Barra), Russell Global Sectors, and the Industry Classification Benchmark (Dow Jones and FTSE).

Industry classification systems developed by government agencies include the International Standard Industrial Classification (ISIC), the North American Industry Classification System (NAICS), and systems designed for the European Union and Australia/New Zealand.

LOS 40.c

A cyclical firm has earnings that are highly dependent on the business cycle. A non-cyclical firm has earnings that are less dependent on the business cycle. Industries can also be classified as cyclical or non-cyclical. Non-cyclical industries or firms can be classified as defensive (demand for the product tends not to fluctuate with the business cycle) or growth (demand is so strong that it is largely unaffected by the business cycle).

Limitations of descriptors such as growth, defensive, and cyclical include the facts that cyclical industries often include growth firms; even non-cyclical industries can be affected by severe recessions; defensive industries are not always safe investments; business cycle timing differs across countries and regions; and the classification of firms is somewhat arbitrary.

LOS 40.d

A peer group should consist of companies with similar business activities, demand drivers, cost structure drivers, and availability of capital. To form a peer group, the analyst will often start by identifying companies in the same industry, but the analyst should use other information to verify that the firms in an industry are comparable.

LOS 40.e

A thorough industry analysis should:

- Evaluate the relationships between macroeconomic variables and industry trends.
- Estimate industry variables using different approaches and scenarios.
- Check estimates against those from other analysts.

- Compare the valuation for different industries.
- Compare the valuation for industries across time to determine risk and rotation strategies.
- Analyze industry prospects based on strategic groups.
- Classify industries by their life-cycle stage.
- Position the industry on the experience curve.
- Consider demographic, macroeconomic, governmental, social, and technological influences.
- Examine the forces that determine industry competition.

LOS 40.f

Strategic analysis of an industry involves analyzing the competitive forces that determine the possibility of economic profits.

Porter's five forces that determine industry competition are:

1. Rivalry among existing competitors.
2. Threat of entry.
3. Threat of substitutes.
4. Power of buyers.
5. Power of suppliers.

LOS 40.g

High barriers to entry prevent new competitors from taking away market share, but they do not guarantee pricing power or high return on capital, especially if the products are undifferentiated or barriers to exit result in overcapacity. Barriers to entry may change over time.

While market fragmentation usually results in strong competition and low return on capital, high industry concentration may not guarantee pricing power. If industry products are undifferentiated, consumers will switch to the cheapest producer. Overcapacity may result in price wars.

Capacity is fixed in the short run and variable in the long run. Undercapacity typically results in pricing power. Producers may overinvest in new capacity, especially in cyclical industries or if the capacity is physical and specialized. Non-physical capacity comes into production and can be reallocated more quickly than physical capacity.

Highly variable market shares indicate a highly competitive industry. Stable market shares suggest less intense competition. High switching costs contribute to market share stability.

LOS 40.h

Phases of the industry life-cycle model are the embryonic, growth, shakeout, maturity, and decline stages.

- Embryonic stage: Slow growth; high prices; large investment required; high risk of failure.
- Growth stage: Rapid growth; little competition; falling prices; increasing profitability.

- Shakeout stage: Slowing growth; intense competition; industry overcapacity; declining profitability; cost cutting; increased failures.
- Mature stage: Slow growth; consolidation; high barriers to entry; stable pricing; superior firms gain market share.
- Decline stage: Negative growth; declining prices; consolidation.

A limitation of life-cycle analysis is that life-cycle stages may not be as long or short as anticipated or might be skipped altogether due to technological change, government regulation, societal change, or demographics. Firms in the same life-cycle stage will experience dissimilar growth and profits due to their competitive positions.

LOS 40.i

The elements of an industry strategic analysis are the major firms, barriers to entry, industry concentration, influence of industry capacity on pricing, industry stability, life cycle, competition, demographic influences, government influence, social influence, technological influence, and whether the industry is growth, defensive, or cyclical.

LOS 40.j

Macroeconomic influences on industries include long-term trends in factors such as GDP growth, interest rates, and inflation, as well as structural factors such as the education level of the workforce.

Demographic influences include the size and age distribution of the population.

Government factors include tax rates, regulations, empowerment of self-regulatory organizations, and government purchases of goods and services.

Social influences relate to how people interact and conduct their lives.

Technology can dramatically change an industry through the introduction of new or improved products.

LOS 40.k

Company analysis should include an overview of the firm, industry characteristics, and analysis of product demand, product costs, the pricing environment, the firm's financial ratios, and projected financial statements and firm valuation. The analysis should describe the company's competitive strategy.

Companies can employ a cost leadership (low-cost) strategy or a product or service differentiation strategy. A cost leadership firm seeks to have the lowest costs of production in its industry, offer the lowest prices, and generate enough volume to make a superior return. A differentiating firm's products and services should be distinctive in terms of type, quality, or delivery.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 40.1

1. **B** The classification systems provided by S&P/MSCI Barra, Russell, and Dow Jones/FTSE classify firms according to the product or service they produce. (LOS 40.b)
2. **B** For industry analysis, cyclical firms and industries are those with earnings that are highly dependent on the business cycle, while non-cyclical firms and industries are those with earnings that are relatively less sensitive to the business cycle. (LOS 40.c)
3. **C** Firms should be included in a peer group if their business activities are comparable. An analyst may begin with available industry classifications when forming peer groups but should refine them based on factors including the firms' sources of demand and earnings and the geographic markets in which they operate. (LOS 40.d)
4. **A** The experience curve shows the cost per unit relative to output. Unit cost declines at higher output volume because of increases in productivity and economies of scale, especially in industries with high fixed costs. (LOS 40.e)
5. **A** Elements of an industry strategic analysis include the major firms, barriers to entry/success, industry concentration, influence of industry capacity on pricing, industry stability, life cycle, competition, demographic influences, government influence, social influence, technological influence, and whether the industry is growth, defensive, or cyclical. (LOS 40.e)
6. **B** Porter's five forces are rivalry among existing competitors, threat of entry, threat of substitutes, bargaining power of buyers, and bargaining power of suppliers. (LOS 40.f)

Module Quiz 40.2

1. **B** Greater concentration (a small number of firms control a large part of the market) typically reduces competition and results in greater pricing power. Greater unused capacity in an industry, especially if chronic, results in greater price competition and less pricing power. Greater stability in market share is typically associated with greater pricing power. (LOS 40.g)
2. **C** In industries with greater ease of entry, firms have little pricing power because new competitors can take away market share. High costs of exiting result in overcapacity and likely price wars. Greater ease of exit (i.e., low costs of exit) increases pricing power. (LOS 40.g)
3. **B** The shakeout stage is characterized by slowed growth, intense competition, industry overcapacity, increased cost cutting, declining profitability, and increased failures. (LOS 40.h)
4. **C** Oil production and home building are both highly cyclical industries. Oil production is dominated by a small number of large global firms, while home construction is characterized by a large number of relatively smaller firms.

Demographics have more influence on housing construction (e.g., the rate of new household formation) than on oil production. (LOS 40.i)

5. **C** Supplier bargaining power is best characterized as a force internal to the industry. External influences on industry growth, profitability, and risk include macroeconomic, technological, demographic, governmental, and social influences. (LOS 40.j)
6. **B** Firms that use a low-cost strategy should have managerial incentives suitable to create efficient operations. In a low-cost strategy, the firm seeks to generate high enough sales volume to make a superior return. Marketing and product development are key elements of a differentiation strategy. (LOS 40.k)

1. Michael Porter, "The Five Competitive Forces That Shape Strategy," *Harvard Business Review*, Volume 86, No. 1: pp. 78–93.

The following is a review of the Equity Investments (2) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #41.

READING 41: EQUITY VALUATION: CONCEPTS AND BASIC TOOLS

Study Session 13

EXAM FOCUS

This topic review discusses the use of discounted cash flow models, price multiples, and asset-based models for stock valuation. Know when the various models are appropriate, how to apply them, and their advantages and disadvantages. This topic is foundational material for all three levels of the CFA exams. Be sure you understand these fundamental concepts.

MODULE 41.1: DIVIDENDS, SPLITS, AND REPURCHASES



Video covering this content is available online.

LOS 41.a: Evaluate whether a security, given its current market price and a value estimate, is overvalued, fairly valued, or undervalued by the market.

CFA® Program Curriculum, Volume 4, page 447

Recall from the topic review of Market Efficiency that **intrinsic value** or **fundamental value** is defined as the rational value investors would place on the asset if they had full knowledge of the asset's characteristics. Analysts use valuation models to estimate the intrinsic values of stocks and compare them to the stocks' market prices to determine whether individual stocks are overvalued, undervalued, or fairly valued. In doing valuation analysis for stocks, analysts are assuming that some stocks' prices deviate significantly from their intrinsic values.

To the extent that market prices deviate from intrinsic values, analysts who can estimate a stock's intrinsic value better than the market can earn abnormal profits if the stock's market price moves toward its intrinsic value over time. There are several things to consider, however, in deciding whether to invest based on differences between market prices and estimated intrinsic values.

1. The larger the percentage difference between market prices and estimated values, the more likely the investor is to take a position based on the estimate of intrinsic value. Small differences between market prices and estimates of intrinsic values are to be expected.
2. The more confident the investor is about the appropriateness of the valuation model used, the more likely the investor is to take an investment position in a stock that is identified as overvalued or undervalued.
3. The more confident the investor is about the estimated inputs used in the valuation model, the more likely the investor is to take an investment position in a stock that is identified as overvalued or undervalued. Analysts must also consider the sensitivity of

a model value to each of its inputs in deciding whether to act on a difference between model values and market prices. If a decrease of one-half percent in the long-term growth rate used in the valuation model would produce an estimated value equal to the market price, an analyst would have to be quite sure of the model's growth estimate to take a position in the stock based on its estimated value.

4. Even if we assume that market prices sometimes deviate from intrinsic values, market prices must be treated as fairly reliable indications of intrinsic value. Investors must consider why a stock is mispriced in the market. Investors may be more confident about estimates of value that differ from market prices when few analysts follow a particular security.
5. Finally, to take a position in a stock identified as mispriced in the market, an investor must believe that the market price will actually move toward (and certainly not away from) its estimated intrinsic value and that it will do so to a significant extent within the investment time horizon.

LOS 41.b: Describe major categories of equity valuation models.

CFA® Program Curriculum, Volume 4, page 448

Analysts use a variety of models to estimate the value of equities. Usually, an analyst will use more than one model with several different sets of inputs to determine a range of possible stock values.

In **discounted cash flow models** (or **present value models**), a stock's value is estimated as the present value of cash distributed to shareholders (*dividend discount models*) or the present value of cash available to shareholders after the firm meets its necessary capital expenditures and working capital expenses (*free cash flow to equity models*).

There are two basic types of **multiplier models** (or **market multiple models**) that can be used to estimate intrinsic values. In the first type, the ratio of stock price to such fundamentals as earnings, sales, book value, or cash flow per share is used to determine if a stock is fairly valued. For example, the price to earnings (P/E) ratio is frequently used by analysts.

The second type of multiplier model is based on the ratio of **enterprise value** to either earnings before interest, taxes, depreciation, and amortization (EBITDA) or revenue. Enterprise value is the market value of all a firm's outstanding securities minus cash and short-term investments. Common stock value can be estimated by subtracting the value of liabilities and preferred stock from an estimate of enterprise value.

In **asset-based models**, the intrinsic value of common stock is estimated as total asset value minus liabilities and preferred stock. Analysts typically adjust the book values of the firm's assets and liabilities to their fair values when estimating the market value of its equity with an asset-based model.

LOS 41.c: Describe regular cash dividends, extra dividends, stock dividends, stock splits, reverse stock splits, and share repurchases.

CFA® Program Curriculum, Volume 4, page 450

Cash dividends, as the name implies, are payments made to shareholders in cash. They may be regularly scheduled dividends or one-time special dividends. **Regular dividends** occur

when a company pays out a portion of profits on a consistent schedule (e.g., quarterly). A long-term record of stable or increasing dividends is widely viewed by investors as a sign of a company's financial stability. **Special dividends** are used when favorable circumstances allow the firm to make a one-time cash payment to shareholders, in addition to any regular dividends the firm pays. Many cyclical firms (e.g., automakers) will use a special dividend to share profits with shareholders when times are good but maintain the flexibility to conserve cash when profits are poor. Other names for special dividends include *extra dividends* and *irregular dividends*.

Stock dividends are dividends paid out in new shares of stock rather than cash. In this case, there will be more shares outstanding, but each one will be worth less. Total shareholders' equity remains unchanged. Stock dividends are commonly expressed as a percentage. A 20% stock dividend means every shareholder gets 20% more stock.

Stock splits divide each existing share into multiple shares, creating more shares. There are now more shares, but the price of each share will drop correspondingly to the number of shares created, so there is no change in the owner's wealth. Splits are expressed as a ratio. In a 3-for-1 stock split, each old share is split into three new shares. Stock splits are currently more common than stock dividends.

Reverse stock splits are the opposite of stock splits. After a reverse split, there are fewer shares outstanding but there is a higher stock price. Because these factors offset one another, shareholder wealth is unchanged.

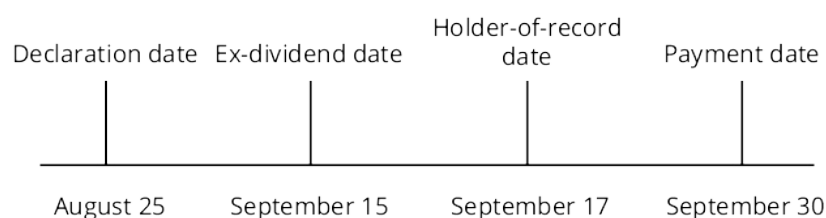
A **share repurchase** is a transaction in which a company buys outstanding shares of its own common stock. Share repurchases are an alternative to cash dividends as a way of distributing cash to shareholders, and they have the same effect on shareholders' wealth as cash dividends of the same size. A company might repurchase shares to support their price or to signal that management believes the shares are undervalued. Share repurchases may also be used to offset an increase in outstanding shares from the exercise of employee stock options. In countries that tax capital gains at lower rates than dividends, shareholders may prefer share repurchases to dividend payments as a way to distribute cash to shareholders.

LOS 41.d: Describe dividend payment chronology.

CFA® Program Curriculum, Volume 4, page 451

The dates relevant to dividend payments are shown in [Figure 41.1](#).

Figure 41.1: Dividend Payment Chronology



Declaration date. The date the board of directors approves payment of a dividend, specifying the per-share dividend amount, the date shareholders must own the stock to receive the dividend (record date), and the date the dividend payment will be made (payment date).

Ex-dividend date. The first day on which a share purchaser will not receive the next dividend. The ex-dividend date is one or two business days before the holder-of-record date, depending on the settlement period for stock purchases. If you buy the share on or after the ex-dividend date, you will not receive the dividend.

Holder-of-record date (record date). The date on which all owners of shares will receive the dividend payment on their shares.

Payment date. The date dividend checks are mailed to, or payment is made electronically to, holders of record.

On the ex-dividend date, the share price will decrease from the previous day's closing price by approximately the amount of the dividend, in the absence of other factors affecting the stock price. Consider shares that are trading at \$25 on the day prior to the ex-dividend date and will pay a \$1 dividend. Purchasing a share on the day prior to the ex-dividend date will give the owner a share of stock and the \$1 dividend on the payment date. Purchasing a share on the ex-dividend date will entitle the owner only to the share; the dividend payment will go to the seller.



MODULE QUIZ 41.1

To best evaluate your performance, enter your quiz answers online.

1. An analyst estimates a value of \$45 for a stock with a market price of \$50. The analyst is *most likely* to conclude that a stock is overvalued if:
 - A. few analysts follow the stock and the analyst has less confidence in his model inputs.
 - B. few analysts follow the stock and the analyst is confident in his model inputs.
 - C. many analysts follow the stock and the analyst is confident in his model inputs.
2. A valuation model based on free cash flow to equity is *most likely* to be:
 - A. a multiplier model.
 - B. an asset-based model.
 - C. a present value model.
3. A company is evaluating the likely effects on its share price of declaring a 50% stock dividend or a 3-for-2 stock split. Other things equal, which of these will result in a lower share price?
 - A. 3-for-2 stock split.
 - B. 50% stock dividend.
 - C. Both should have the same effect.
4. The first date on which the purchaser of a stock will not receive a dividend that has been declared is:
 - A. the declaration date.
 - B. the ex-dividend date.
 - C. the holder-of-record date.

MODULE 41.2: DIVIDEND DISCOUNT MODELS



LOS 41.e: Explain the rationale for using present value models to value equity and describe the dividend discount and free-cash-flow-to-equity models.

Video covering this content is available online.

CFA® Program Curriculum, Volume 4, page 453

The **dividend discount model** (DDM) is based on the rationale that the intrinsic value of stock is the present value of its future dividends.

The most general form of the model is as follows:

$$V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1 + k_e)^t}$$

where:

V_0 = current stock value

D_t = dividend at time t

k_e = required rate of return on common equity

One-year holding period DDM. For a holding period of one year, the value of the stock today is the present value of any dividends during the year plus the present value of the expected price of the stock at the end of the year (referred to as its **terminal value**).

The one-year holding period DDM is simply:

$$\text{value} = \frac{\text{dividend to be received}}{(1+k_e)} + \frac{\text{year-end price}}{(1+k_e)}$$

EXAMPLE: One-period DDM valuation

Calculate the value of a stock that paid a \$1 dividend last year, if next year's dividend will be 5% higher and the stock will sell for \$13.45 at year-end. The required return is 13.2%.

Answer:

The next dividend is the current dividend increased by the estimated growth rate. In this case, we have:

$$D_1 = D_0 \times (1 + \text{dividend growth rate}) = \$1.00 \times (1 + 0.05) = \$1.05$$

The present value of the expected future cash flows is:

$$\text{dividend: } \frac{\$1.05}{1.132} = \$0.93$$

$$\text{year-end price: } \frac{\$13.45}{1.132} = \$11.88$$

The current value based on the investor's expectations is:

$$\text{stock value} = \$0.93 + \$11.88 = \$12.81$$

Multiple-year holding period DDM. With a multiple-year holding period, we simply sum the present values of the estimated dividends over the holding period and the estimated terminal value.

For a two-year holding period, we have:

$$\text{value} = \frac{D_1}{(1+k_e)} + \frac{D_2}{(1+k_e)^2} + \frac{P_2}{(1+k_e)^2}$$



PROFESSOR'S NOTE

It is useful to think of the subscript t on dividends (D_t) and prices (P_t) as the end of period t . For example, in the preceding equation, P_2 is the price at the end of Year 2. Think of it as the selling price of a share, immediately after D_2 is received.

EXAMPLE: Multiple-period DDM valuation

A stock recently paid a dividend of \$1.50 which is expected to grow at 8% per year. The required rate of return of 12%. Calculate the value of this stock assuming that it will be priced at \$51.00 three years from now.

Answer:

Find the PV of the future dividends:

$$D_1 = \$1.50(1.08) = \$1.62$$

$$D_2 = \$1.50(1.08)^2 = \$1.75$$

$$D_3 = \$1.50(1.08)^3 = \$1.89$$

$$\text{PV of dividends} = \$1.62 / 1.12 + \$1.75 / (1.12)^2 + \$1.89 / (1.12)^3 = \$4.19$$

Find the PV of the future price:

$$\$51.00 / (1.12)^3 = \$36.30$$

Add the present values. The current value based on the investor's expectations is $\$4.19 + \$36.30 = \$40.49$.

The most general form of the DDM uses an infinite holding period because a corporation has an indefinite life. In an infinite-period DDM model, the present value of all expected future dividends is calculated and there is no explicit terminal value for the stock. In practice, as we will see, a terminal value can be calculated at a time in the future after which the growth rate of dividends is expected to be constant.

Free cash flow to equity (FCFE) is often used in discounted cash flow models instead of dividends because it represents the potential amount of cash that could be paid out to common shareholders. That is, FCFE reflects the firm's capacity to pay dividends. FCFE is also useful for firms that do not currently pay dividends.

FCFE is defined as the cash remaining after a firm meets all of its debt obligations and provides for the capital expenditures necessary to maintain existing assets and to purchase the new assets needed to support the assumed growth of the firm. In other words, it is the cash available to the firm's equity holders after a firm meets all of its other obligations. FCFE for a period is often calculated as:

$$\text{FCFE} = \text{net income} + \text{depreciation} - \text{increase in working capital} - \text{fixed capital investment (FCInv)} - \text{debt principal repayments} + \text{new debt issues}$$

FCFE can also be calculated as:

$$\text{FCFE} = \text{cash flow from operations} - \text{FCInv} + \text{net borrowing}$$

In the second formula, **net borrowing** is the increase in debt during the period (i.e., amount borrowed minus amount repaid) and is assumed to be available to shareholders. Fixed capital investment must be subtracted because the firm must invest in assets to sustain itself. FCFE is projected for future periods using the firm's financial statements.

Restating the general form of the DDM in terms of FCFE, we have:

$$V_0 = \sum_{t=1}^{\infty} \frac{\text{FCFE}_t}{(1+k_e)^t}$$

Estimating the required return for equity

The capital asset pricing model (CAPM) provides an estimate of the required rate of return (k_i) for security i as a function of its systematic risk (β_i), the risk-free rate (R_f), and the expected return on the market [$E(R_{mkt})$] as:

$$k_i = R_f + \beta_i[E(R_{mkt}) - R_f]$$

There is some controversy over whether the CAPM is the best model to calculate the required return on equity. Also, different analysts will likely use different inputs, so there is no single number that is correct.



PROFESSOR'S NOTE

The CAPM is discussed in detail in Portfolio Management.

Recall from the topic review of Cost of Capital that for firms with publicly traded debt, analysts often estimate the required return on the firm's common equity by adding a risk premium to the firm's current bond yield. If the firm does not have publicly traded debt, an analyst can add a larger risk premium to a government bond yield.

LOS 41.f: Calculate the intrinsic value of a non-callable, non-convertible preferred stock.

CFA® Program Curriculum, Volume 4, page 456

Preferred stock pays a dividend that is usually fixed and usually has an indefinite maturity. When the dividend is fixed and the stream of dividends is infinite, the infinite period dividend discount model reduces to a simple ratio:

$$\text{preferred stock value} = \frac{D_p}{(1+k_p)^1} + \frac{D_p}{(1+k_p)^2} + \dots + \frac{D_p}{(1+k_p)^x} = \frac{D_p}{k_p}$$

EXAMPLE: Preferred stock valuation

A company's \$100 par preferred stock pays a \$5.00 annual dividend and has a required return of 8%. Calculate the value of the preferred stock.

Answer:

Value of the preferred stock: $D_p / k_p = \$5.00 / 0.08 = \62.50

LOS 41.g: Calculate and interpret the intrinsic value of an equity security based on the Gordon (constant) growth dividend discount model or a two-stage dividend discount model, as appropriate.

CFA® Program Curriculum, Volume 4, page 459

The **Gordon growth model** (or **constant growth model**) assumes the annual growth rate of dividends, g_c , is constant. Hence, next period's dividend, D_1 , is $D_0(1 + g_c)$, the second year's dividend, D_2 , is $D_0(1 + g_c)^2$, and so on. The extended equation using this assumption gives the present value of the expected future dividends (V_0) as:

$$V_0 = \frac{D_0(1+g_c)}{(1+k_e)} + \frac{D_0(1+g_c)^2}{(1+k_e)^2} + \frac{D_0(1+g_c)^3}{(1+k_e)^3} + \dots + \frac{D_0(1+g_c)^\infty}{(1+k_e)^\infty}$$

When the growth rate of dividends is constant, this equation simplifies to the Gordon (constant) growth model:

$$V_0 = \frac{D_0(1+g_c)}{k_e - g_c} = \frac{D_1}{k_e - g_c}$$



PROFESSOR'S NOTE

In much of the finance literature, you will see this model referred to as the constant growth DDM, infinite period DDM, or the Gordon growth model. Whatever you call it, memorize D_1 over (k minus g). Note that our valuation model for preferred stock is the same as the constant growth model with no growth ($g = 0$).

The assumptions of the Gordon growth model are:

- Dividends are the appropriate measure of shareholder wealth.
- The constant dividend growth rate, g_c , and required return on stock, k_e , are never expected to change.
- k_e must be greater than g_c . If not, the math will not work.

If any one of these assumptions is not met, the model is not appropriate.

EXAMPLE: Gordon growth model valuation

Calculate the value of a stock that paid a \$1.50 dividend last year, if dividends are expected to grow at 8% forever and the required return on equity is 12%.

Answer:

Determine D_1 : $D_0(1 + g_c) = \$1.50(1.08) = \1.62

$$\begin{aligned}\text{Calculate the stock's value} &= D_1 / (k_e - g_c) \\ &= \$1.62 / (0.12 - 0.08) \\ &= \$40.50\end{aligned}$$



PROFESSOR'S NOTE

When doing stock valuation problems on the exam, watch for words like “forever,” “infinitely,” “indefinitely,” “for the foreseeable future,” and so on. This will tell you that the Gordon growth model should be used. Also watch for words like “just paid” or “recently paid.” These will refer to the last dividend, D_0 . Words like “will pay” or “is expected to pay” refer to D_1 .

This example demonstrates that the stock's value is determined by the relationship between the investor's required rate of return on equity, k_e , and the projected growth rate of dividends, g_c :

- As the difference between k_e and g_c widens, the value of the stock falls.
- As the difference narrows, the value of the stock rises.
- Small changes in the difference between k_e and g_c can cause large changes in the stock's value.

Because the estimated stock value is very sensitive to the denominator, an analyst should calculate several different value estimates using a range of required returns and growth rates.

An analyst can also use the Gordon growth model to determine how much of the estimated stock value is due to dividend growth. To do this, assume the growth rate is zero and calculate a value. Then, subtract this value from the stock value estimated using a positive growth rate.

EXAMPLE: Amount of estimated stock value due to dividend growth

Using the data from the previous example, calculate how much of the estimated stock value is due to dividend growth.

Answer:

The estimated stock value with a growth rate of zero is:

$$V_0 = D / k = \$1.50 / 0.12 = \$12.50$$

The amount of the estimated stock value due to estimated dividend growth is:

$$\$40.50 - \$12.50 = \$28.00$$

Estimating the growth rate in dividends

To estimate the growth rate in dividends, the analyst can use three methods:

1. Use the historical growth in dividends for the firm.
2. Use the median industry dividend growth rate.
3. Estimate the sustainable growth rate.

The **sustainable growth rate** is the rate at which equity, earnings, and dividends can continue to grow indefinitely assuming that ROE is constant, the dividend payout ratio is constant, and no new equity is sold.

$$\text{sustainable growth} = (1 - \text{dividend payout ratio}) \times \text{ROE}$$

The quantity $(1 - \text{dividend payout ratio})$ is also referred to as the **retention rate**, the proportion of net income that is not paid out as dividends and goes to retained earnings, thus increasing equity.

EXAMPLE: Sustainable growth rate

Green, Inc., is expected to pay dividends equal to 25% of earnings. Green's ROE is 21%. Calculate and interpret its sustainable growth rate.

Answer:

$$g = (1 - 0.25) \times 21\% = 15.75\%$$

With long-run economic growth typically in the single digits, it is unlikely that a firm could sustain 15.75% growth forever. The analyst should also examine the growth rate for the industry and the firm's historical growth rate to determine whether the estimate is reasonable.

Some firms do not currently pay dividends but are expected to begin paying dividends at some point in the future. A firm may not currently pay a dividend because it is in financial distress and cannot afford to pay out cash or because the return the firm can earn by

reinvesting cash is greater than what stockholders could expect to earn by investing dividends elsewhere.

For these firms, an analyst must estimate the amount and timing of the first dividend in order to use the Gordon growth model. Because these parameters are highly uncertain, the analyst should check the estimate from the Gordon growth model against estimates made using other models.

EXAMPLE: A firm with no current dividend

A firm currently pays no dividend but is expected to pay a dividend at the end of Year 4. Year 4 earnings are expected to be \$1.64, and the firm will maintain a payout ratio of 50%. Assuming a constant growth rate of 5% and a required rate of return of 10%, estimate the current value of this stock.

Answer:

The first step is to find the value of the stock at the end of Year 3. Remember, P_3 is the present value of dividends in Years 4 through infinity, calculated at the end of Year 3, one period *before* the first dividend is paid.

Calculate D_4 , the estimate of the dividend that will be paid at the end of Year 4:

$$D_4 = (\text{dividend payout ratio})(E_4) = (0.5)(1.64) = \$0.82$$

Apply the constant growth model to estimate V_3 :

$$V_3 = D_4 / (k_e - g_c) = \$0.82 / (0.10 - 0.05) = \$16.40$$

The second step is to calculate the current value, V_0 :

$$V_0 = 16.40 / 1.1^3 = \$12.32$$

Multistage Dividend Growth Models

A firm may temporarily experience a growth rate that exceeds the required rate of return on the firm's equity, but no firm can maintain this relationship indefinitely. A firm with an extremely high growth rate will attract competition, and its growth rate will eventually fall. We must assume the firm will return to a more sustainable rate of growth at some point in the future in order to calculate the present value of expected future dividends.

One way to value a dividend-paying firm that is experiencing temporarily high growth is to add the present values of dividends expected during the high-growth period to the present value of the constant growth value of the firm at the end of the high-growth period. This is referred to as the **multistage dividend discount model**.

$$\text{value} = \frac{D_1}{(1+k_e)} + \frac{D_2}{(1+k_e)^2} + \dots + \frac{D_n}{(1+k_e)^n} + \frac{P_n}{(1+k_e)^n}$$

where $P_n = \frac{D_{n+1}}{k_e - g_c}$ is the terminal stock value, assuming that dividends at $t = n + 1$ and beyond grow at a constant rate of g_c .

Steps in using the multistage model:

- Determine the discount rate, k_e .
- Project the size and duration of the high initial dividend growth rate, g^* .
- Estimate dividends during the high-growth period.

- Estimate the constant growth rate at the end of the high-growth period, g_c .
- Estimate the first dividend that will grow at the constant rate.
- Use the constant growth value to calculate the stock value at the end of the high-growth period.
- Add the PVs of all dividends to the PV of the terminal value of the stock.

EXAMPLE: Multistage growth

Consider a stock with dividends that are expected to grow at 15% per year for two years, after which they are expected to grow at 5% per year, indefinitely. The last dividend paid was \$1.00, and $k_e = 11\%$. Calculate the value of this stock using the multistage growth model.

Answer:

Calculate the dividends over the high-growth period:

$$D_1 = D_0(1 + g^*) = 1.00(1.15) = \$1.15$$

$$D_2 = D_1(1 + g^*) = 1.15(1.15) = 1.15^2 = \$1.32$$

Although we increase D_1 by the high growth rate of 15% to get D_2 , D_2 will grow at the constant growth rate of 5% for the foreseeable future. This property of D_2 allows us to use the constant growth model formula with D_2 to get P_1 , a time = 1 value for all the (infinite) dividends expected from time = 2 onward.

$$P_1 = \frac{D_2}{k_e - g_c} = \frac{1.32}{0.11 - 0.05} = 22.00$$

Finally, we can sum the present values of dividend 1 and of P_1 to get the present value of all the expected future dividends during both the high- and constant growth periods:

$$\frac{1.15 + 22.00}{1.11} = \$20.86$$



PROFESSOR'S NOTE

Many finance textbooks solve multiple stage growth problems like this one by using the first dividend that has grown at the constant long-term rate to calculate the terminal value, one period after the dividend we have used. Except for rounding, this results in the same current stock value. In fact, the constant growth model can be employed using any dividend during the assumed constant growth period.

A common mistake with multistage growth problems is to calculate the future value, P_1 in this example, and then to either forget to discount it back to the present or to discount over the number of periods until the constant growth dividend is paid (two in this example) rather than using the correct number of periods for discounting the constant growth value (one period in the example). Don't make these mistakes because question writers like to present these common errors as answer choices.

LOS 41.h: Identify characteristics of companies for which the constant growth or a multistage dividend discount model is appropriate.

CFA® Program Curriculum, Volume 4, page 463

The Gordon growth model uses a single constant growth rate of dividends and is most appropriate for valuing stable and mature, non-cyclical, dividend-paying firms.

For dividend-paying firms with dividends that are expected to grow rapidly, slowly, or erratically over some period, followed by constant dividend growth, some form of the multistage growth model should be employed. The important points are that dividends must

be estimable and must grow at a constant rate after some initial period so that the constant growth model can be used to determine the terminal value of the stock. Thus, we can apply multistage dividend growth models to a firm with high current growth that will drop to a stable rate in the future or to a firm that is temporarily losing market share and growing slowly or getting smaller, as long as its growth is expected to stabilize to a constant rate at some point in the future.

One variant of a multistage growth model assumes that the firm has three stages of dividend growth, not just two. These three stages can be categorized as growth, transition, and maturity. A 3-stage model would be suitable for firms with an initial high growth rate, followed by a lower growth rate during a second, transitional period, followed by the constant growth rate in the long run, such as a young firm still in the high growth phase.

When a firm does not pay dividends, estimates of dividend payments some years in the future are highly speculative. In this case, and in any case where future dividends cannot be estimated with much confidence, valuation based on FCFE is appropriate as long as growth rates of earnings can be estimated. In other cases, valuation based on price multiples may be more appropriate.



MODULE QUIZ 41.2

To best evaluate your performance, enter your quiz answers online.

1. The constant growth model requires which of the following?
 - A. $g < k$.
 - B. $g > k$.
 - C. $g \neq k$.
2. What would an investor be willing to pay for a share of preferred stock that pays an annual \$7 dividend if the required return is 7.75%?
 - A. \$77.50.
 - B. \$87.50.
 - C. \$90.32.
3. An analyst estimates that a stock will pay a \$2 dividend next year and that it will sell for \$40 at year-end. If the required rate of return is 15%, what is the value of the stock?
 - A. \$33.54.
 - B. \$36.52.
 - C. \$43.95.
4. What is the intrinsic value of a company's stock if dividends are expected to grow at 5%, the most recent dividend was \$1, and investors' required rate of return for this stock is 10%?
 - A. \$20.00.
 - B. \$21.00.
 - C. \$22.05.
5. Assume that a stock is expected to pay dividends at the end of Year 1 and Year 2 of \$1.25 and \$1.56, respectively. Dividends are expected to grow at a 5% rate thereafter. Assuming that k_e is 11%, the value of the stock is *closest* to:
 - A. \$22.30.
 - B. \$23.42.
 - C. \$24.55.
6. An analyst feels that Brown Company's earnings and dividends will grow at 25% for two years, after which growth will fall to a constant rate of 6%. If the projected discount rate is 10%, and Brown's most recently paid dividend was \$1, the value of Brown's stock using the multistage dividend discount model is *closest* to:
 - A. \$31.25.
 - B. \$33.54.
 - C. \$36.65.

7. Which of the following firms would *most likely* be appropriately valued using the constant growth DDM?
- A. An auto manufacturer.
 - B. A producer of bread and snack foods.
 - C. A biotechnology firm in existence for two years.

MODULE 41.3: RELATIVE VALUATION MEASURES



Video covering this content is available online.

LOS 41.i: Explain the rationale for using price multiples to value equity, how the price to earnings multiple relates to fundamentals, and the use of multiples based on comparables.

CFA® Program Curriculum, Volume 4, page 468

Because the dividend discount model is very sensitive to its inputs, many investors rely on other methods. In a **price multiple** approach, an analyst compares a stock's price multiple to a benchmark value based on an index, industry group of firms, or a peer group of firms within an industry. Common price multiples used for valuation include price-to-earnings, price-to-cash flow, price-to-sales, and price-to-book value ratios.

Price multiples are widely used by analysts and readily available in numerous media outlets. Price multiples are easily calculated and can be used in time series and cross-sectional comparisons. Many of these ratios have been shown to be useful for predicting stock returns, with low multiples associated with higher future returns.

A critique of price multiples is that they reflect only the past because historical (trailing) data are often used in the denominator. For this reason, many practitioners use forward (leading or prospective) values in the denominator (sales, book value, earnings, etc.). The use of projected values can result in much different ratios. An analyst should be sure to use price multiple calculations consistently across firms.

When we compare a price multiple, such as P/E, for a firm to those of other firms based on market prices, we are using **price multiples based on comparables**. By contrast, **price multiples based on fundamentals** tell us what a multiple should be based on some valuation model and therefore are not dependent on the current market prices of other companies to establish value.

LOS 41.j: Calculate and interpret the following multiples: price to earnings, price to an estimate of operating cash flow, price to sales, and price to book value.

CFA® Program Curriculum, Volume 4, page 468

Price multiples used for valuation include:

- **Price-earnings (P/E) ratio:** The P/E ratio is a firm's stock price divided by earnings per share and is widely used by analysts and cited in the press.
- **Price-sales (P/S) ratio:** The P/S ratio is a firm's stock price divided by sales per share.
- **Price-book value (P/B) ratio:** The P/B ratio is a firm's stock price divided by book value of equity per share.
- **Price-cash flow (P/CF) ratio:** The P/CF ratio is a firm's stock price divided by cash flow per share, where cash flow may be defined as operating cash flow or free cash

flow.

Other multiples can be used that are industry specific. For example, in the cable television industry, stock market capitalization is compared to the number of subscribers.

Multiples Based on Fundamentals

To understand fundamental price multiples, consider the Gordon growth valuation model:

$$P_0 = \frac{D_1}{k-g}$$

If we divide both sides of the equation by next year's projected earnings, E_1 , we get

$$\frac{P_0}{E_1} = \frac{D_1/E_1}{k-g}$$

which is the leading P/E for this stock if it is valued in the market according to the constant growth DDM.

This P/E based on fundamentals is also referred to as a **justified P/E**. It is “justified” because, assuming we have the correct inputs for D_1 , E_1 , k , and g , the previous equation will provide a P/E ratio that is based on the present value of the future cash flows. We refer to this as a *leading P/E ratio* because it is based on expected earnings next period, not on actual earnings for the previous period, which would produce a lagging or *trailing P/E ratio*.

One advantage of this approach is that it makes clear how the firm's P/E ratio should be related to its fundamentals. It illustrates that the P/E ratio is a function of:

- D_1 / E_1 = expected dividend payout ratio.
- k = required rate of return on the stock.
- g = expected constant growth rate of dividends.

EXAMPLE: P/E based on fundamentals

A firm has an expected dividend payout ratio of 30%, a required rate of return of 13%, and an expected dividend growth rate of 6%. Calculate the firm's fundamental (justified) leading P/E ratio.

Answer:

$$\text{expected P/E ratio} = 0.3 / (0.13 - 0.06) = 4.3$$

The justified P/E ratio serves as a benchmark for the price at which the stock should trade. In the previous example, if the firm's actual P/E ratio (based on the market price and expected earnings) was 8, the stock would be considered overvalued. If the firm's market P/E ratio was 2, the stock would be considered undervalued.

P/E ratios based on fundamentals are very sensitive to the inputs (especially the denominator, $k - g$), so the analyst should use several different sets of inputs to indicate a range for the justified P/E.

Because we started with the equation for the constant growth DDM, the P/E ratio calculated in this way is the P/E ratio consistent with the constant growth DDM. We can see from the formula that, *other things equal*, the P/E ratio we have defined here will increase with (1) a higher dividend payout rate, (2) a higher growth rate, or (3) a lower required rate of return.

So, if the subject firm has a higher dividend payout ratio, higher growth rate, and lower required return than its peers, a higher P/E ratio may be justified.

In practice, other things are not equal. An increase in the dividend payout ratio, for example, will reduce the firm's sustainable growth rate. While higher dividends will increase firm value, a lower growth rate will decrease firm value. This relationship is referred to as the **dividend displacement of earnings**. The net effect on firm value of increasing the dividend payout ratio is ambiguous. As intuition would suggest, firms cannot continually increase their P/Es or market values by increasing the dividend payout ratio. Otherwise, all firms would have 100% payout ratios.



PROFESSOR'S NOTE

Watch for the wording “other things equal” or “other variables unchanged” in any exam questions about the effect of changing one variable.

EXAMPLE: Fundamental P/E ratio comparison

Holt Industries makes decorative items. The following figures are for Holt and its industry.

	Holt Industries	Industry Average
Dividend payout ratio	25%	16%
Sales growth	7.5%	3.9%
Total debt to equity	113%	68%

Which of these factors suggest a higher fundamental P/E ratio for Holt?

Answer:

- The higher dividend payout ratio supports Holt having a higher P/E ratio than the industry.
- Higher growth in sales suggests that Holt will be able to increase dividends at a faster rate, which supports Holt having a higher P/E ratio than the industry.
- The higher level of debt, however, indicates that Holt has higher risk and a higher required return on equity, which supports Holt having a lower P/E ratio than the industry.

Multiples Based on Comparables

Valuation based on price multiple comparables (or comps) involves using a price multiple to evaluate whether an asset is valued properly relative to a benchmark. Common benchmarks include the stock's historical average (a time series comparison) or similar stocks and industry averages (a cross-sectional comparison). Comparing firms within an industry is useful for analysts who are familiar with a particular industry. Price multiples are readily calculated and provided by many media outlets.

The economic principle guiding this method is the **law of one price**, which asserts that two identical assets should sell at the same price, or in this case, two comparable assets should have approximately the same multiple.

The analyst should be sure that any comparables used really are comparable. Price multiples may not be comparable across firms if the firms are different sizes, are in different industries, or will grow at different rates. Furthermore, using P/E ratios for cyclical firms is complicated

due to their sensitivity to economic conditions. In this case, the P/S ratio may be favored over the P/E ratio because the sales are less volatile than earnings due to both operating and financial leverage.

The disadvantages of using price multiples based on comparables are (1) a stock may appear overvalued by the comparable method but undervalued by the fundamental method, or vice versa; (2) different accounting methods can result in price multiples that are not comparable across firms, especially internationally; and (3) price multiples for cyclical firms may be greatly affected by economic conditions at a given point in time.

EXAMPLE: Valuation using comparables

The following figures are for Renee's Bakery. All figures except the stock price are in millions.

Fiscal Year-End	20X3	20X2	20X1
Total stockholder's equity	\$55.60	\$54.10	\$52.60
Net revenues	\$77.30	\$73.60	\$70.80
Net income	\$3.20	\$1.10	\$0.40
Net cash flow from operations	\$17.90	\$15.20	\$12.20
Stock price	\$11.40	\$14.40	\$12.05
Shares outstanding	4.476	3.994	3.823

Calculate Renee's lagging P/E, P/CF, P/S, and P/B ratios. Judge whether the firm is undervalued or overvalued using the following relevant industry averages for 20X3 and the firm's historical trend.

Lagging Industry Ratios	20X3
Price-to-earnings	8.6
Price-to-cash flow	4.6
Price-to-sales	1.4
Price-to-book value	3.6

Answer:

To calculate the lagging price multiples, first divide the relevant financial statement items by the number of shares to get per-share amounts. Then, divide the stock price by this figure.

For example, for the P/S ratio for 20X3, divide net revenue (net sales) by the number of shares:

$$\frac{\text{sales}}{\text{number of shares}} = \frac{\$77.30}{4.476} = 17.270$$

Then, divide the stock price by sales per share:

$$\frac{P}{S} = \frac{\$11.40}{17.3} = 0.7$$

Using the net income for earnings, the net cash flow from operations for the cash flow, and stockholder's equity for book value, the ratios for Renee's Bakery are:

	20X3	20X2	20X1
P/E	15.9	52.3	115.2
P/CF	2.9	3.8	3.8
P/S	0.7	0.8	0.7
P/B	0.9	1.1	0.9

Comparing Renee's Bakery's ratios to the industry averages for 20X3, the price multiples are lower in all cases except for the P/E multiple. This cross-sectional evidence suggests that Renee's Bakery is undervalued.

The P/E ratio merits further investigation. Renee's Bakery may have a higher P/E because its earnings are depressed by high depreciation, interest expense, or taxes. Calculating the price-EBITDA ratio would provide an alternative measure that is unaffected by these expenses.

On a time series basis, the ratios are trending downward. This indicates that Renee's Bakery may be currently undervalued relative to its past valuations. We could also calculate average price multiples for the ratios over 20X1–20X3 as a benchmark for the current values:

Company average P/E 20X1–20X3	61.1
Company average P/CF 20X1–20X3	3.5
Company average P/S 20X1–20X3	0.7
Company average P/B 20X1–20X3	1.0

The current P/E, P/CF, and P/B ratios are lower than their 3-year averages. This indicates that Renee's Bakery may be currently undervalued. It also may be the case, however, that P/E ratios for the market as a whole have been decreasing over the period due to systematic factors.

LOS 41.k: Describe enterprise value multiples and their use in estimating equity value.

CFA® Program Curriculum, Volume 4, page 477

Enterprise value (EV) measures total company value. EV can be viewed as what it would cost to acquire the firm:

EV = market value of common and preferred stock + market value of debt – cash and short-term investments

Cash and short-term investments are subtracted because an acquirer's cost for a firm would be decreased by the amount of the target's liquid assets. Although an acquirer assumes the firm's debt, it also receives the firm's cash and short-term investments. Enterprise value is

appropriate when an analyst wants to compare the values of firms that have significant differences in capital structure.

EBITDA (earnings before interest, taxes, depreciation, and amortization are subtracted) is probably the most frequently used denominator for EV multiples; operating income can also be used. Because the numerator represents total company value, it should be compared to earnings of both debt and equity owners. An advantage of using EBITDA instead of net income is that EBITDA is usually positive even when earnings are not. When net income is negative, value multiples based on earnings are meaningless. A disadvantage of using EBITDA is that it often includes non-cash revenues and expenses.

A potential problem with using enterprise value is that the market value of a firm's debt is often not available. In this case, the analyst can use the market values of similar bonds or can use their book values. Book value, however, may not be a good estimate of market value if firm and market conditions have changed significantly since the bonds were issued.

EXAMPLE: Calculating EV/EBITDA multiples

Daniel, Inc., is a manufacturer of small refrigerators and other appliances. The following figures are from Daniel's most recent financial statements except for the market value of long-term debt, which has been estimated from financial market data.

Stock price	\$40.00
Shares outstanding	200,000
Market value of long-term debt	\$600,000
Book value of long-term debt	\$900,000
Book value of total debt	\$2,100,000
Cash and marketable securities	\$250,000
EBITDA	\$1,000,000

Calculate the EV/EBITDA multiple.

Answer:

First, we must estimate the market value of the firm's short-term debt and liabilities. To do so, subtract the book value of long-term debt from the book value of total debt: $\$2,100,000 - \$900,000 = \$1,200,000$. This is the book value of the firm's short-term debt. We can assume the market value of these short-term items is close to their book value. (As we will see in the Study Session on fixed income valuation, the market values of debt instruments approach their face values as they get close to maturity.)

Add the market value of long-term debt to get the market value of total debt: $\$600,000 + \$1,200,000 = \$1,800,000$.

The market value of equity is the stock price multiplied by the number of shares: $\$40 \times 200,000 = \$8,000,000$.

The enterprise value of the firm is the sum of debt and equity minus cash: $\$1,800,000 + \$8,000,000 - \$250,000 = \$9,550,000$.

$$\text{EV/EBITDA} = \$9,550,000 / \$1,000,000 \approx 9.6.$$

If the competitor or industry average EV/EBITDA is above 9.6, Daniel is relatively undervalued. If the competitor or industry average EV/EBITDA is below 9.6, Daniel is relatively overvalued.

LOS 41.I: Describe asset-based valuation models and their use in estimating equity value.

CFA[®] Program Curriculum, Volume 4, page 479

Our third category of valuation model is **asset-based models**, which are based on the idea that equity value is the market or fair value of assets minus the market or fair value of liabilities. Because market values of firm assets are usually difficult to obtain, the analyst typically starts with the balance sheet to determine the values of assets and liabilities. In most cases, market values are not equal to book values. Possible approaches to valuing assets are to value them at their depreciated values, inflation-adjusted depreciated values, or estimated replacement values.

Applying asset-based models is especially problematic for a firm that has a large amount of intangible assets, on or off the balance sheet. The effect of the loss of the current owners' talents and customer relationships on forward earnings may be quite difficult to measure. Analysts often consider asset-based model values as floor or minimum values when significant intangibles, such as business reputation, are involved. An analyst should consider supplementing an asset-based valuation with a more forward-looking valuation, such as one from a discounted cash flow model.

Asset-based model valuations are most reliable when the firm has primarily tangible short-term assets, assets with ready market values (e.g., financial or natural resource firms), or when the firm will cease to operate and is being liquidated. Asset-based models are often used to value private companies but may be increasingly useful for public firms as they move toward fair value reporting on the balance sheet.

EXAMPLE: Using an asset-based model for a public firm

Williams Optical is a publicly traded firm. An analyst estimates that the market value of net fixed assets is 120% of book value. Liability and short-term asset market values are assumed to equal their book values. The firm has 2,000 shares outstanding.

Using the selected financial results in the table, calculate the value of the firm's net assets on a per-share basis.

Cash	\$10,000
Accounts receivable	\$20,000
Inventories	\$50,000
Net fixed assets	<u>\$120,000</u>
Total assets	\$200,000

Accounts payable	\$5,000
Notes payable	\$30,000
Term loans	\$45,000
Common stockholder equity	<u>\$120,000</u>
Total liabilities and equity	\$200,000

Answer:

Estimate the market value of assets, adjusting the fixed assets for the analyst's estimates of their market values:

$$\$10,000 + \$20,000 + \$50,000 + \$120,000(1.20) = \$224,000$$

Determine the market value of liabilities:

$$\$5,000 + 30,000 + \$45,000 = \$80,000$$

Calculate the adjusted equity value:

$$\$224,000 - \$80,000 = \$144,000$$

Calculate the adjusted equity value per share:

$$\$144,000 / 2,000 = \$72$$

LOS 41.m: Explain advantages and disadvantages of each category of valuation model.

CFA® Program Curriculum, Volume 4, page 448

Advantages of discounted cash flow models:

- They are based on the fundamental concept of discounted present value and are well grounded in finance theory.
- They are widely accepted in the analyst community.

Disadvantages of discounted cash flow models:

- Their inputs must be estimated.
- Value estimates are very sensitive to input values.

Advantages of comparable valuation using price multiples:

- Evidence that some price multiples are useful for predicting stock returns.
- Price multiples are widely used by analysts.
- Price multiples are readily available.
- They can be used in time series and cross-sectional comparisons.
- EV/EBITDA multiples are useful when comparing firm values independent of capital structure or when earnings are negative and the P/E ratio cannot be used.

Disadvantages of comparable valuation using price multiples:

- Lagging price multiples reflect the past.
- Price multiples may not be comparable across firms if the firms have different size, products, and growth.
- Price multiples for cyclical firms may be greatly affected by economic conditions at a given point in time.
- A stock may appear overvalued by the comparable method but undervalued by a fundamental method or vice versa.
- Different accounting methods can result in price multiples that are not comparable across firms, especially internationally.
- A negative denominator in a price multiple results in a meaningless ratio. The P/E ratio is especially susceptible to this problem.

Advantages of price multiple valuations based on fundamentals:

- They are based on theoretically sound valuation models.
- They correspond to widely accepted value metrics.

Disadvantage of price multiple valuations based on fundamentals:

- Price multiples based on fundamentals will be very sensitive to the inputs (especially the $k - g$ denominator).

Advantages of asset-based models:

- They can provide floor values.
- They are most reliable when the firm has primarily tangible short-term assets, assets with ready market values, or when the firm is being liquidated.
- They are increasingly useful for valuing public firms that report fair values.

Disadvantages of asset-based models:

- Market values are often difficult to obtain.
- Market values are usually different than book values.
- They are inaccurate when a firm has a high proportion of intangible assets or future cash flows not reflected in asset values.
- Assets can be difficult to value during periods of hyperinflation.



MODULE QUIZ 41.3

To best evaluate your performance, enter your quiz answers online.

1. Which of the following is *least likely* a rationale for using price multiples?
 - A. Price multiples are easily calculated.
 - B. The fundamental P/E ratio is insensitive to its inputs.
 - C. The use of forward values in the divisor provides an incorporation of the future.
2. A firm has an expected dividend payout ratio of 60% and an expected future growth rate of 7%. What should the firm's fundamental price-to-earnings (P/E) ratio be if the required rate of return on stocks of this type is 15%?
 - A. 5.0×
 - B. 7.5×
 - C. 10.0×
3. Enterprise value is defined as the market value of equity plus:
 - A. the face value of debt minus cash and short-term investments.

- B. the market value of debt minus cash and short-term investments.
 - C. cash and short-term investments minus the market value of debt.
4. Which of the following firms would *most appropriately* be valued using an asset-based model?
- A. An energy exploration firm in financial distress that owns drilling rights for offshore areas.
 - B. A paper firm located in a country that is experiencing high inflation.
 - C. A software firm that invests heavily in research and development and frequently introduces new products.
5. Which type of valuation model is viewed as having the disadvantage of producing results that may not be comparable across firms?
- A. Asset-based models.
 - B. Price multiple models.
 - C. Discounted cash flow models.

KEY CONCEPTS

LOS 41.a

An asset is fairly valued if the market price is equal to its estimated intrinsic value, undervalued if the market price is less than its estimated value, and overvalued if the market price is greater than the estimated value.

For security valuation to be profitable, the security must be mispriced now and price must converge to intrinsic value over the investment horizon.

Securities that are followed by many investors are more likely to be fairly valued than securities that are neglected by analysts.

LOS 41.b

Discounted cash flow models estimate the present value of cash distributed to shareholders (dividend discount models) or the present value of cash available to shareholders after meeting capital expenditures and working capital expenses (free cash flow to equity models).

Multiplier models compare the stock price to earnings, sales, book value, or cash flow. Alternatively, enterprise value is compared to sales or EBITDA.

Asset-based models define a stock's value as the firm's total asset value minus liabilities and preferred stock, on a per-share basis.

LOS 41.c

Regular cash dividends are paid at set intervals. A special dividend is a one-time cash payment to shareholders.

Stock dividends are additional shares of stock. Stock splits divide each existing share into multiple shares. In either case, the value of each share will decrease because the total value of outstanding shares is unchanged. The portion of the company owned by each shareholder is also unchanged.

In a reverse stock split, the number of shares owned by each shareholder is decreased, so total shares outstanding are decreased and the value of a single share is increased.

A share repurchase is a purchase by the company of its outstanding shares. Share repurchases are an alternative to cash dividends as a way to distribute cash to shareholders.

LOS 41.d

Dividend payment chronology:

- Declaration date: The date the board of directors approves payment of the dividend.
- Ex-dividend date: The first day a share of stock trades without the dividend, one or two business days before the holder-of-record date. On the ex-dividend date, the value of each share decreases by the amount of the dividend.
- Holder-of-record date: The date on which share owners who will receive the dividend are identified.
- Payment date. The date the dividend checks are sent to, or payment is transferred to, shareholders.

LOS 41.e

The dividend discount model is based on the rationale that a corporation has an indefinite life, and a stock's value is the present value of its future cash dividends. The most general form of the model is:

$$V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1 + k_e)^t}$$

Free cash flow to equity (FCFE) can be used instead of dividends. FCFE is the cash remaining after a firm meets all of its debt obligations and provides for necessary capital expenditures. FCFE reflects the firm's capacity for dividends and is useful for firms that currently do not pay a dividend. By using FCFE, an analyst does not need to project the amount and timing of future dividends.

LOS 41.f

Preferred stock typically pays a fixed dividend and does not mature. It is valued as:

$$\text{preferred stock value} = \frac{D_p}{k_p}$$

LOS 41.g

The Gordon growth model assumes the growth rate in dividends is constant:

$$V_0 = \frac{D_1}{k_e - g_c}$$

The sustainable growth rate is the rate at which earnings and dividends can continue to grow indefinitely:

$$g = b \times \text{ROE}$$

where:

b = earnings retention rate = 1 – dividend payout rate

ROE = return on equity

A firm with high growth over some number of periods followed by a constant growth rate of dividends forever can be valued using a multistage model:

$$\text{value} = \frac{D_1}{(1+k_e)} + \frac{D_2}{(1+k_e)^2} + \dots + \frac{D_n}{(1+k_e)^n} + \frac{P_n}{(1+k_e)^n}$$

where:

$$P_n = \frac{D_{n+1}}{k_e - g_c}$$

g_c = constant growth rate of dividends

n = number of periods of supernormal growth

LOS 41.h

The constant growth model is most appropriate for firms that pay dividends that grow at a constant rate, such as stable and mature firms or noncyclical firms such as utilities and food producers in mature markets.

A 2-stage DDM would be most appropriate for a firm with high current growth that will drop to a stable rate in the future, an older firm that is experiencing a temporary high growth phase, or an older firm with a market share that is decreasing but expected to stabilize.

A 3-stage model would be appropriate for a young firm still in a high growth phase.

LOS 41.i

The P/E ratio based on fundamentals is calculated as:

$$\frac{P_0}{E_1} = \frac{D_1/E_1}{k-g}$$

If the subject firm has a higher dividend payout ratio, higher growth rate, and lower required return than its peers, it may be justified in having a higher P/E ratio.

Price multiples are widely used by analysts, are easily calculated and readily available, and can be used in time series and cross-sectional comparisons.

LOS 41.j

The price-earnings (P/E) ratio is a firm's stock price divided by earnings per share.

The price-sales (P/S) ratio is a firm's stock price divided by sales per share.

The price-book value (P/B) ratio is a firm's stock price divided by book value per share.

The price-cash flow (P/CF) ratio is a firm's stock price divided by cash flow per share. Cash flow may be defined as operating cash flow or free cash flow.

LOS 41.k

Enterprise value (EV) measures total company value:

$$EV = \text{market value of common and preferred stock} + \text{market value of debt} - \text{cash and short-term investments}$$

EBITDA is frequently used as the denominator in EV multiples because EV represents total company value, and EBITDA represents earnings available to all investors.

LOS 41.l

Asset-based models value equity as the market or fair value of assets minus liabilities. These models are most appropriate when a firm's assets are largely tangible and have fair values that can be established easily.

LOS 41.m

Advantages of discounted cash flow models:

- Easy to calculate.
- Widely accepted in the analyst community.
- FCFE model is useful for firms that currently do not pay a dividend.
- Gordon growth model is useful for stable, mature, noncyclical firms.
- Multistage models can be used for firms with nonconstant growth.

Disadvantages of discounted cash flow models:

- Inputs must be forecast.
- Estimates are very sensitive to inputs.
- For the Gordon growth model specifically:
 - Very sensitive to the $k - g$ denominator.

- Required return on equity must be greater than the growth rate.
- Required return on equity and growth rate must remain constant.
- Firm must pay dividends.

Advantages of price multiples:

- Often useful for predicting stock returns.
- Widely used by analysts.
- Easily calculated and readily available.
- Can be used in time series and cross-sectional comparisons.
- EV/EBITDA multiples are useful when comparing firm values independent of capital structure or when earnings are negative and the P/E ratio cannot be used.

Disadvantages of price multiples:

- P/E ratio based on fundamentals will be very sensitive to the inputs.
- May not be comparable across firms, especially internationally.
- Multiples for cyclical firms may be greatly affected by economic conditions. P/E ratio may be especially inappropriate. (The P/S multiple may be more appropriate for cyclical firms.)
- A stock may appear overvalued by the comparable method but undervalued by the fundamental method or vice versa.
- Negative denominator results in a meaningless ratio; the P/E ratio is especially susceptible to this problem.
- A potential problem with EV/EBITDA multiples is that the market value of a firm's debt is often not available.

Advantages of asset-based models:

- Can provide floor values.
- Most reliable when the firm has mostly tangible short-term assets, assets with a ready market value, or when the firm is being liquidated.
- May be increasingly useful for valuing public firms if they report fair values.

Disadvantages of asset-based models:

- Market values of assets can be difficult to obtain and are usually different than book values.
- Inaccurate when a firm has a large amount of intangible assets or future cash flows not reflected in asset value.
- Asset values can be difficult to value during periods of hyperinflation.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 41.1

1. **B** If the analyst is more confident of his input values, he is more likely to conclude that the security is overvalued. The market price is more likely to be correct for a security followed by many analysts and less likely correct when few analysts follow the security. (LOS 41.a)
2. **C** One example of a present value model is valuation based on the present value of future cash flows available to equity holders. (LOS 41.b)
3. **C** Both a 50% stock dividend and a 3-for-2 stock split will increase the number of shares by 50%, while neither will affect value of the company. Therefore, the decrease in the share price should be the same in either case. (LOS 41.c)
4. **B** The chronology of a dividend payout is declaration date, ex-dividend date, holder-of-record date, and payment date. The ex-dividend date is the cutoff date for receiving the dividend: stocks purchased on or after the ex-dividend date will not receive the dividend. (LOS 41.d)

Module Quiz 41.2

1. **A** For the constant growth model, the constant growth rate (g) must be less than the required rate of return (k). (LOS 41.e)
2. **C** The share value is $7.0 / 0.0775 = \$90.32$. (LOS 41.f)
3. **B** $(\$40 + \$2) / 1.15 = \$36.52$. (LOS 41.g)
4. **B** Using the constant growth model, $\$1(1.05) / (0.10 - 0.05) = \21.00 . (LOS 41.g)
5. **C** $(\$1.25 / 1.11) + [1.56 / (0.11 - 0.05)] / 1.11 = \24.55 . (LOS 41.g)
6. **C** $\$1(1.25) / 1.1 + [\$1(1.25)^2 / (0.10 - 0.06)] / 1.1 = \36.65 . (LOS 41.g)
7. **B** The constant growth DDM assumes that the dividend growth rate is constant. The most likely choice here is the bread and snack producer. Auto manufacturers are more likely to be cyclical than to experience constant growth. A biotechnology firm in existence for two years is unlikely to pay a dividend, and if it does, dividend growth is unlikely to be constant. (LOS 41.h)

Module Quiz 41.3

1. **B** The fundamental P/E ratio is sensitive to its inputs. It uses the DDM as its framework, and the denominator $k - g$ in both has a large impact on the calculated P/E or stock value. (LOS 41.i)
2. **B** Using the earnings multiplier model, $0.6 / (0.15 - 0.07) = 7.5\times$. (LOS 41.j)
3. **B** Enterprise value is market value of equity plus market value of debt minus cash and short-term investments. (LOS 41.k)

4. **A** The energy exploration firm would be most appropriately valued using an asset-based model. Its near-term cash flows are likely negative, so a forward-looking model is of limited use. Furthermore, it has valuable assets in the form of drilling rights that likely have a readily determined market value. The paper firm would likely not be appropriately valued using an asset-based model because high inflation makes the values of a firm's assets more difficult to estimate. An asset-based model would not be appropriate to value the software firm because the firm's value largely consists of internally developed intangible assets. (LOS 41.l)
5. **B** Results that may not be comparable across firms are considered a disadvantage of valuation models based on price multiples. (LOS 41.m)

TOPIC ASSESSMENT: EQUITY INVESTMENTS

You have now finished the Equity Investments topic section. The following Topic Assessment provides immediate feedback on how effective your study has been for this material. The number of questions on this test is equal to the number of questions for the topic on one-half of the actual Level I CFA exam. Questions are more exam-like than typical Module Quiz or QBank questions; a score of less than 70% indicates that your study likely needs improvement. These tests are best taken timed; allow 1.5 minutes per question.

After you've completed this Topic Assessment, you may additionally log in to your [Schweser.com](https://www.schweser.com) online account and enter your answers in the Topic Assessments product. Select "Performance Tracker" to view a breakdown of your score. Select "Compare with Others" to display how your score on the Topic Assessment compares to the scores of others who entered their answers.

1. An investor purchased 550 shares of Akley common stock for \$38,500 in a margin account and posted initial margin of 50%. The maintenance margin requirement is 35%. The price of Akley, below which the investor would get a margin call, is *closest* to:
 - A. \$45.00.
 - B. \$54.00.
 - C. \$59.50.
2. Adams owns 100 shares of Brikley stock, which is trading at \$86 per share, and Brown is short 200 shares of Brikley. Adams wants to buy 100 more shares if the price rises to \$90, and Brown wants to cover his short position and take profits if the price falls to \$75. The orders Adams and Brown should enter to accomplish their stated objectives are:

<u>Adams</u>	<u>Brown</u>
A. Limit buy @ 90	Limit buy @ 75
B. Limit buy @ 90	Stop buy @ 75
C. Stop buy @ 90	Limit buy @ 75
3. Which of the factors that determine the intensity of industry competition is *most likely* to be affected by the presence of significant economies of scale?
 - A. Threat of entry.
 - B. Threat of substitutes.
 - C. Power of suppliers.
4. Price-to-book value ratios are *most appropriate* for measuring the relative value of:
 - A. a bank.
 - B. a manufacturing company.
 - C. a mature technology company.
5. An index of three non-dividend paying stocks is weighted by their market values. One of the index stocks splits 2-for-1 during the year, but no shares are sold. The total return of this index for the year is:
 - A. less than the price return of the index.
 - B. equal to the price return of the index.
 - C. greater than the price return of the index.

6. Financial intermediaries that buy securities from and sell securities to investors are *best* described as:
- A. dealers.
 - B. brokers.
 - C. investment bankers.
7. Among the types of assets that trade in organized markets, asset-backed securities are *best* characterized as:
- A. real assets.
 - B. equity securities.
 - C. pooled investment vehicles.
8. Which of the following market indexes is likely to be rebalanced *most* frequently? An index that is:
- A. price weighted.
 - B. value weighted.
 - C. equal weighted.
9. Rogers Partners values stocks using a dividend discount model and the CAPM. Holding all other factors constant, which of the following is *least likely* to increase the estimated value of a stock?
- A. An increase in the next period's expected dividend.
 - B. A decrease in the stock's systematic risk.
 - C. A decrease in the expected growth rate of dividends.
10. Brandy Clark, CFA, has forecast that Aceler, Inc., will pay its first dividend two years from now in the amount of \$1.25. For the following year, she forecasts a dividend of \$2.00 and expects dividends to increase at an average rate of 7% for the foreseeable future after that. If the risk-free rate is 4.5%, the expected market risk premium is 7.5%, and Aceler's beta is 0.9, Clark would estimate the current value of Aceler shares as being *closest* to:
- A. \$37.
 - B. \$39.
 - C. \$47.
11. The industry that is classified the more cyclical sector under a commercial industry classification scheme is:
- A. personal care products.
 - B. food.
 - C. apparel.
12. Compared to a passive investment strategy, active management, on average:
- A. cannot outperform if markets are weak-form efficient.
 - B. can outperform if markets are weak-form efficient but not semistrong-form efficient.
 - C. can outperform if markets are semistrong-form efficient but not strong-form efficient.
13. Malley, Inc., is a manufacturer of sports apparel. Pruett, Inc., produces cardboard boxes for packaging. In a typical industry classification system from a commercial index provider, in which sectors are these firms *most likely* to be classified?
- | | |
|---------------------|----------------------|
| <u>Malley, Inc.</u> | <u>Pruette, Inc.</u> |
|---------------------|----------------------|

- | | |
|---------------------------|----------------------------------|
| A. Consumer staples | Basic materials and processing |
| B. Consumer discretionary | Basic materials and processing |
| C. Consumer staples | Industrial and producer durables |

14. Assuming the value effect persists over time, which of the following strategies would be *most likely* to earn positive abnormal returns? Purchase stocks with:
- A. low dividend yields.
 - B. high market-to-book ratios.
 - C. low price-to-earnings ratios.

TOPIC ASSESSMENT ANSWERS: EQUITY INVESTMENTS

1. **B** The price below which the investor would receive a margin call is:

$$\left(\frac{38,500}{550} \right) \left(\frac{1-0.5}{1-0.35} \right) = \$53.85$$

(Study Session 12, Module 36.2, LOS 36.f)

2. **C** Adams should enter a stop buy at 90, which will be executed only if the stock price rises to 90. Brown should enter a buy order with a limit at 75 because he wants to buy stock to close out his short position if he can purchase it at 75 (or less). (Study Session 12, Module 36.2, LOS 36.g)
3. **A** Economies of scale represent a barrier to entry into an industry. Existing competitors are likely to be operating on a large scale that new entrants would find difficult and expensive to develop, reducing the threat of entry. (Study Session 13, Module 40.2, LOS 40.g)
4. **A** Price-to-book value is an appropriate measure of relative value for firms that hold primarily liquid assets, such as banks. Manufacturing companies typically have a large proportion of fixed assets for which the book value (historical cost less depreciation) may be less relevant as a measure of their economic value. A mature technology company likely has valuable intangible assets, such as patents and human capital, that may not be reflected fully (or at all) on the balance sheet. (Study Session 13, Module 41.3, LOS 41.i)
5. **B** Because the stocks in the index do not pay dividends, there is no difference between the price return and the total return of the index. (Study Session 12, Module 37.1, LOS 37.b)
6. **A** Dealers maintain inventories of securities and buy them from and sell them to investors. Brokers do not trade directly with clients but find buyers for and sellers of securities to execute customer orders. Investment banks are primarily involved in assisting with the issuance of new securities. (Study Session 12, Module 36.1, LOS 36.d)
7. **C** Asset-backed securities represent claims to a portion of a financial asset pool. (Study Session 12, Module 36.1, LOS 36.c)
8. **C** An equal-weighted index is not equal weighted after even one day, unless all stocks in the index change by the same percentage. A change in share price preserves the weightings in a value-weighted index and preserves the weightings in a price-weighted index unless the price change results from a stock split or stock dividend. (Study Session 12, Module 37.2, LOS 37.f)
9. **C** Other things equal, a decrease in the expected growth rate of dividends (g) will decrease the value of a stock estimated with the dividend discount model. According to the CAPM, a decrease in the stock's systematic risk would decrease the required return on equity, increasing the DDM value of future dividends. Other things equal, an increase in a company's next dividend will increase share value. (Study Session 13, Module 41.2, LOS 41.e)

10. **B** The required rate of return on Aceler shares is $4.5 + 0.9(7.5) = 11.25\%$. Note that the expected market risk premium $= E(R_{\text{mkt}}) - R_f$, so there is no need to subtract the risk-free rate.
- The dividend at $t = 3$, \$2.00, is expected to grow at 7% for the foreseeable future, so the DDM value of Aceler shares at $t = 2$ is $2 / (0.1125 - 0.07) = 47.06$.
- The $t = 0$ value of the shares is $(47.06 + 1.25) / 1.1125^2 = \39.03 . (Study Session 13, Module 41.2, LOS 41.g)
11. **C** Food and personal care products are typically included in the “consumer staples” sector of commercial classification systems. Apparel is included in the “consumer discretionary” sector, which is more cyclical than the “consumer staples” sector. (Study Session 13, Module 40.1, LOS 40.d)
12. **B** One of the implications of market efficiency is that if markets are semistrong-form efficient, active portfolio management cannot consistently outperform (achieve positive risk-adjusted returns relative to) a passive strategy. (Study Session 12, Module 38.1, LOS 38.e)
13. **B** Apparel manufacturers are typically classified as consumer discretionary. Packaging firms are typically classified as basic materials and processing. (Study Session 13, Module 40.1, LOS 40.b)
14. **C** The value effect refers to value stocks outperforming growth stocks on a risk-adjusted basis. Value stocks have low price-to-earnings or market-to-book ratios, or high dividend yields. Growth stocks have high price-to-earnings or market-to-book ratios, or low dividend yields. If the value effect persists over time and is not the result of inadequate adjustment for risk, buying value stocks will produce positive abnormal returns. (Study Session 12, Module 38.1, LOS 38.f)

The following is a review of the Fixed Income (1) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #42.

READING 42: FIXED-INCOME SECURITIES: DEFINING ELEMENTS

Study Session 14

EXAM FOCUS

Here your focus should be on learning the basic characteristics of debt securities and as much of the bond terminology as you can remember. Key items are the coupon structure of bonds and options embedded in bonds: call options, put options, and conversion (to common stock) options.

MODULE 42.1: BOND INDENTURES, REGULATION, AND TAXATION



Video covering this content is available online.

There are two important points about fixed-income securities that we will develop further along in the Fixed Income study sessions but may be helpful as you read this topic review.

- The most common type of fixed-income security is a bond that promises to make a series of interest payments in fixed amounts and to repay the principal amount at maturity. When market interest rates (i.e., yields on bonds) *increase*, the value of such bonds *decreases* because the present value of a bond's promised cash flows decreases when a higher discount rate is used.
- Bonds are rated based on their relative probability of default (failure to make promised payments). Because investors prefer bonds with lower probability of default, bonds with lower credit quality must offer investors higher yields to compensate for the greater probability of default. Other things equal, a decrease in a bond's rating (an increased probability of default) will decrease the price of the bond, thus increasing its yield.

LOS 42.a: Describe basic features of a fixed-income security.

CFA® Program Curriculum: Volume 5, page 7

The features of a fixed-income security include specification of:

- The issuer of the bond.
- The maturity date of the bond.
- The par value (principal value to be repaid).
- Coupon rate and frequency.
- Currency in which payments will be made.

Issuers of Bonds

There are several types of entities that issue bonds when they borrow money, including:

- **Corporations.** Often corporate bonds are divided into those issued by financial companies and those issued by nonfinancial companies.
- **Sovereign national governments.** A prime example is U.S. Treasury bonds, but many countries issue sovereign bonds.
- **Non-sovereign governments.** Issued by government entities that are not national governments, such as the state of California or the city of Toronto.
- **Quasi-government entities.** Not a direct obligation of a country's government or central bank. An example is the Federal National Mortgage Association (Fannie Mae).
- **Supranational entities.** Issued by organizations that operate globally such as the World Bank, the European Investment Bank, and the International Monetary Fund (IMF).

Bond Maturity

The maturity date of a bond is the date on which the principal is to be repaid. Once a bond has been issued, the time remaining until maturity is referred to as the **term to maturity** or **tenor** of a bond.

When bonds are issued, their terms to maturity range from one day to 30 years or more. Both Disney and Coca-Cola have issued bonds with original maturities of 100 years. Bonds that have no maturity date are called **perpetual bonds**. They make periodic interest payments but do not promise to repay the principal amount.

Bonds with original maturities of one year or less are referred to as **money market securities**. Bonds with original maturities of more than one year are referred to as **capital market securities**.

Par Value

The **par value** of a bond is the **principal amount** that will be repaid at maturity. The par value is also referred to as the *face value*, *maturity value*, *redemption value*, or *principal value* of a bond. Bonds can have a par value of any amount, and their prices are quoted as a percentage of par. A bond with a par value of \$1,000 quoted at 98 is selling for \$980.

A bond that is selling for more than its par value is said to be trading at a **premium** to par; a bond that is selling at less than its par value is said to be trading at a **discount** to par; and a bond that is selling for exactly its par value is said to be trading **at par**.

Coupon Payments

The coupon rate on a bond is the annual percentage of its par value that will be paid to bondholders. Some bonds make coupon interest payments annually, while others make semiannual, quarterly, or monthly payments. A \$1,000 par value semiannual-pay bond with a 5% coupon would pay 2.5% of \$1,000, or \$25, every six months. A bond with a fixed coupon rate is called a **plain vanilla** bond or a **conventional** bond.

Some bonds pay no interest prior to maturity and are called **zero-coupon bonds** or **pure discount bonds**. *Pure discount* refers to the fact that these bonds are sold at a discount to their par value and the interest is all paid at maturity when bondholders receive the par value.

A 10-year, \$1,000, zero-coupon bond yielding 7% would sell at about \$500 initially and pay \$1,000 at maturity. We discuss various other coupon structures later in this topic review.

Currencies

Bonds are issued in many currencies. Sometimes borrowers from countries with volatile currencies issue bonds denominated in euros or U.S. dollars to make them more attractive to a wide range of investors. A **dual-currency bond** makes coupon interest payments in one currency and the principal repayment at maturity in another currency. A **currency option bond** gives bondholders a choice of which of two currencies they would like to receive their payments in.

LOS 42.b: Describe content of a bond indenture.

LOS 42.c: Compare affirmative and negative covenants and identify examples of each.

CFA® Program Curriculum: Volume 5, page 13

The legal contract between the bond issuer (borrower) and bondholders (lenders) is called a **trust deed**, and in the United States and Canada, it is also often referred to as the **bond indenture**. The indenture defines the obligations of and restrictions on the borrower and forms the basis for all future transactions between the bondholder and the issuer.

The provisions in the bond indenture are known as *covenants* and include both *negative covenants* (prohibitions on the borrower) and *affirmative covenants* (actions the borrower promises to perform).

Negative covenants include restrictions on asset sales (the company can't sell assets that have been pledged as collateral), negative pledge of collateral (the company can't claim that the same assets back several debt issues simultaneously), and restrictions on additional borrowings (the company can't borrow additional money unless certain financial conditions are met).

Negative covenants serve to protect the interests of bondholders and prevent the issuing firm from taking actions that would increase the risk of default. At the same time, the covenants must not be so restrictive that they prevent the firm from taking advantage of opportunities that arise or responding appropriately to changing business circumstances.

Affirmative covenants do not typically restrict the operating decisions of the issuer. Common affirmative covenants are to make timely interest and principal payments to bondholders, to insure and maintain assets, and to comply with applicable laws and regulations.

LOS 42.d: Describe how legal, regulatory, and tax considerations affect the issuance and trading of fixed-income securities.

CFA® Program Curriculum: Volume 5, page 21

Bonds are subject to different legal and regulatory requirements depending on where they are issued and traded. Bonds issued by a firm domiciled in a country and also traded in that country's currency are referred to as **domestic bonds**. Bonds issued by a firm incorporated in a foreign country that trade on the **national bond market** of another country in that country's currency are referred to as **foreign bonds**. Examples include bonds issued by foreign firms

that trade in China and are denominated in yuan, which are called *panda bonds*, and bonds issued by firms incorporated outside the United States that trade in the United States and are denominated in U.S. dollars, which are called *Yankee bonds*.

Eurobonds are issued outside the jurisdiction of any one country and denominated in a currency different from the currency of the countries in which they are sold. They are subject to less regulation than domestic bonds in most jurisdictions and were initially introduced to avoid U.S. regulations. Eurobonds should not be confused with bonds denominated in euros or thought to originate in Europe, although they can be both. Eurobonds got the “euro” name because they were first introduced in Europe, and most are still traded by firms in European capitals. A bond issued by a Chinese firm that is denominated in yen and traded in markets outside Japan would fit the definition of a Eurobond. Eurobonds that trade in the national bond market of a country other than the country that issues the currency the bond is denominated in, and in the Eurobond market, are referred to as **global bonds**.

Eurobonds are referred to by the currency they are denominated in. Eurodollar bonds are denominated in U.S. dollars, and euroyen bonds are denominated in yen. At one time, the majority of Eurobonds were issued in **bearer** form. Ownership of bearer bonds is evidenced simply by possessing the bonds, whereas ownership of **registered bonds** is recorded. Bearer bonds may be more attractive than registered bonds to those seeking to avoid taxes. As with most other bonds, Eurobonds are now issued in registered form.

Other legal and regulatory issues addressed in a trust deed include:

- Legal information about the entity issuing the bond.
- Any assets (collateral) pledged to support repayment of the bond.
- Any additional features that increase the probability of repayment (credit enhancements).
- Covenants describing any actions the firm must take and any actions the firm is prohibited from taking.

Issuing entities

Bonds are issued by several types of legal entities, and bondholders must be aware of which entity has actually promised to make the interest and principal payments. Sovereign bonds are most often issued by the treasury of the issuing country.

Corporate bonds may be issued by a well-known corporation such as Microsoft, by a subsidiary of a company, or by a holding company that is the overall owner of several operating companies. Bondholders must pay attention to the specific entity issuing the bonds because the credit quality can differ among related entities.

Sometimes an entity is created solely for the purpose of owning specific assets and issuing bonds to provide the funds to purchase the assets. These entities are referred to as **special purpose entities** (SPEs) in the United States and special purpose vehicles (SPVs) in Europe. Bonds issued by these entities are called **securitized bonds**. As an example, a firm could sell loans it has made to customers to an SPE that issues bonds to purchase the loans. The interest and principal payments on the loans are then used to make the interest and principal payments on the bonds.

Often, an SPE can issue bonds at a lower interest rate than bonds issued by the originating corporation. This is because the assets supporting the bonds are owned by the SPE and are

used to make the payments to holders of the securitized bonds even if the company itself runs into financial trouble. For this reason, SPEs are called **bankruptcy remote vehicles** or entities.

Sources of repayment

Sovereign bonds are typically repaid by the tax receipts of the issuing country. Bonds issued by non-sovereign government entities are repaid by either general taxes, revenues of a specific project (e.g., an airport), or by special taxes or fees dedicated to bond repayment (e.g., a water district or sewer district).

Corporate bonds are generally repaid from cash generated by the firm's operations. As noted previously, securitized bonds are repaid from the cash flows of the financial assets owned by the SPE.

Collateral and credit enhancements

Unsecured bonds represent a claim to the overall assets and cash flows of the issuer.

Secured bonds are backed by a claim to specific assets of a corporation, which reduces their risk of default and, consequently, the yield that investors require on the bonds. Assets pledged to support a bond issue (or any loan) are referred to as **collateral**.

Because they are backed by collateral, secured bonds are *senior* to unsecured bonds. Among unsecured bonds, two different issues may have different priority in the event of bankruptcy or liquidation of the issuing entity. The claim of senior unsecured debt is below (after) that of secured debt but ahead of *subordinated*, or junior, debt.

Sometimes secured debt is referred to by the type of collateral pledged. **Equipment trust certificates** are debt securities backed by equipment such as railroad cars and oil drilling rigs. **Collateral trust bonds** are backed by financial assets, such as stocks and (other) bonds. Be aware that while the term **debentures** refers to unsecured debt in the United States and elsewhere, in Great Britain and some other countries the term refers to bonds collateralized by specific assets.

The most common type of securitized bond is a **mortgage-backed security** (MBS). The underlying assets are a pool of mortgages, and the interest and principal payments from the mortgages are used to pay the interest and principal on the MBS.

In some countries, especially European countries, financial companies issue **covered bonds**. Covered bonds are similar to asset-backed securities, but the underlying assets (the cover pool), although segregated, remain on the balance sheet of the issuing corporation (i.e., no SPE is created). Special legislation protects the assets in the cover pool in the event of firm insolvency (they are bankruptcy remote). In contrast to an SPE structure, covered bonds also provide recourse to the issuing firm that must replace or augment non-performing assets in the cover pool so that it always provides for the payment of the covered bond's promised interest and principal payments.

Credit enhancement can be either internal (built into the structure of a bond issue) or external (provided by a third party). One method of internal credit enhancement is *overcollateralization*, in which the collateral pledged has a value greater than the par value of the debt issued. One limitation of this method of credit enhancement is that the additional

collateral is also the underlying assets, so when asset defaults are high, the value of the excess collateral declines in value.

Two other methods of internal credit enhancement are a *cash reserve fund* and an *excess spread account*. A cash reserve fund is cash set aside to make up for credit losses on the underlying assets. With an excess spread account, the yield promised on the bonds issued is less than the promised yield on the assets supporting the ABS. This gives some protection if the yield on the financial assets is less than anticipated. If the assets perform as anticipated, the excess cash flow from the collateral can be used to retire (pay off the principal on) some of the outstanding bonds.

Another method of internal credit enhancement is to divide a bond issue into *tranches* (French for *slices*) with different seniority of claims. Any losses due to poor performance of the assets supporting a securitized bond are first absorbed by the bonds with the lowest seniority, then the bonds with the next-lowest priority of claims. The most senior tranches in this structure can receive very high credit ratings because the probability is very low that losses will be so large that they cannot be absorbed by the subordinated tranches. The subordinated tranches must have higher yields to compensate investors for the additional risk of default. This is sometimes referred to as *waterfall structure* because available funds first go to the most senior tranche of bonds, then to the next-highest priority bonds, and so forth.

External credit enhancements include surety bonds, bank guarantees, and letters of credit from financial institutions. *Surety bonds* are issued by insurance companies and are a promise to make up any shortfall in the cash available to service the debt. *Bank guarantees* serve the same function. A *letter of credit* is a promise to lend money to the issuing entity if it does not have enough cash to make the promised payments on the covered debt. While all three of these external credit enhancements increase the credit quality of debt issues and decrease their yields, deterioration of the credit quality of the guarantor will also reduce the credit quality of the covered issue.

Taxation of Bond Income

Most often, the interest income paid to bondholders is taxed as ordinary income at the same rate as wage and salary income. The interest income from bonds issued by municipal governments in the United States, however, is most often exempt from national income tax and often from any state income tax in the state of issue.

When a bondholder sells a coupon bond prior to maturity, it may be at a gain or a loss relative to its purchase price. Such gains and losses are considered capital gains income (rather than ordinary taxable income). Capital gains are often taxed at a lower rate than ordinary income. Capital gains on the sale of an asset that has been owned for more than some minimum amount of time may be classified as *long-term* capital gains and taxed at an even lower rate.

Pure-discount bonds and other bonds sold at significant discounts to par when issued are termed **original issue discount (OID)** bonds. Because the gains over an OID bond's tenor as the price moves towards par value are really interest income, these bonds can generate a tax liability even when no cash interest payment has been made. In many tax jurisdictions, a portion of the discount from par at issuance is treated as taxable interest income each year. This tax treatment also allows that the tax basis of the OID bonds is increased each year by the amount of interest income recognized, so there is no additional capital gains tax liability at maturity.

Some tax jurisdictions provide a symmetric treatment for bonds issued at a premium to par, allowing part of the premium to be used to reduce the taxable portion of coupon interest payments.



MODULE QUIZ 42.1

To best evaluate your performance, enter your quiz answers online.

1. A dual-currency bond pays coupon interest in a currency:
 - A. of the bondholder's choice.
 - B. other than the home currency of the issuer.
 - C. other than the currency in which it repays principal.
2. A bond's indenture:
 - A. contains its covenants.
 - B. is the same as a debenture.
 - C. relates only to its interest and principal payments.
3. A clause in a bond indenture that requires the borrower to perform a certain action is *most accurately* described as:
 - A. a trust deed.
 - B. a negative covenant.
 - C. an affirmative covenant.
4. An investor buys a pure-discount bond, holds it to maturity, and receives its par value. For tax purposes, the increase in the bond's value is *most likely* to be treated as:
 - A. a capital gain.
 - B. interest income.
 - C. tax-exempt income.

MODULE 42.2: BOND CASH FLOWS AND CONTINGENCIES



Video covering this content is available online.

LOS 42.e: Describe how cash flows of fixed-income securities are structured.

CFA® Program Curriculum: Volume 5, page 26

A typical bond has a **bullet** structure. Periodic interest payments (coupon payments) are made over the life of the bond, and the principal value is paid with the final interest payment at maturity. The interest payments are referred to as the bond's **coupons**. When the final payment includes a lump sum in addition to the final period's interest, it is referred to as a **balloon payment**.

Consider a \$1,000 face value 5-year bond with an annual coupon rate of 5%. With a bullet structure, the bond's promised payments at the end of each year would be as follows.

Year	1	2	3	4	5
PMT	\$50	\$50	\$50	\$50	\$1,050
Principal remaining	\$1,000	\$1,000	\$1,000	\$1,000	\$0

A loan structure in which the periodic payments include both interest and some repayment of principal (the amount borrowed) is called an **amortizing loan**. If a bond (loan) is **fully amortizing**, this means the principal is fully paid off when the last periodic payment is made.

Typically, automobile loans and home loans are fully amortizing loans. If the 5-year, 5% bond in the previous table had a fully amortizing structure rather than a bullet structure, the payments and remaining principal balance at each year-end would be as follows (final payment reflects rounding of previous payments).

Year	1	2	3	4	5
PMT	\$230.97	\$230.97	\$230.97	\$230.97	\$230.98
Principal remaining	\$819.03	\$629.01	\$429.49	\$219.99	\$0

A bond can also be structured to be **partially amortizing** so that there is a balloon payment at bond maturity, just as with a bullet structure. However, unlike a bullet structure, the final payment includes just the remaining unamortized principal amount rather than the full principal amount. In the following table, the final payment includes \$200 to repay the remaining principal outstanding.

Year	1	2	3	4	5
PMT	\$194.78	\$194.78	\$194.78	\$194.78	\$394.78
Principal remaining	\$855.22	\$703.20	\$543.58	\$375.98	\$0

Sinking fund provisions provide for the repayment of principal through a series of payments over the life of the issue. For example, a 20-year issue with a face amount of \$300 million may require that the issuer retire \$20 million of the principal every year beginning in the sixth year.

Details of sinking fund provisions vary. There may be a period during which no sinking fund redemptions are made. The amount of bonds redeemed according to the sinking fund provision could decline each year or increase each year.

The price at which bonds are redeemed under a sinking fund provision is typically par but can be different from par. If the market price is less than the sinking fund redemption price, the issuer can satisfy the sinking fund provision by buying bonds in the open market with a par value equal to the amount of bonds that must be redeemed. This would be the case if interest rates had risen since issuance so that the bonds were trading below the sinking fund redemption price.

Sinking fund provisions offer both advantages and disadvantages to bondholders. On the plus side, bonds with a sinking fund provision have less credit risk because the periodic redemptions reduce the total amount of principal to be repaid at maturity. The presence of a sinking fund, however, can be a disadvantage to bondholders when interest rates fall.

This disadvantage to bondholders can be seen by considering the case where interest rates have fallen since bond issuance, so the bonds are trading at a price above the sinking fund redemption price. In this case, the bond trustee will select outstanding bonds for redemption randomly. A bondholder would suffer a loss if her bonds were selected to be redeemed at a price below the current market price. This means the bonds have more *reinvestment risk*

because bondholders who have their bonds redeemed can only reinvest the funds at the new, lower yield (assuming they buy bonds of similar risk).



PROFESSOR'S NOTE

The concept of reinvestment risk is developed more in subsequent topic reviews. It can be defined as the uncertainty about the interest to be earned on cash flows from a bond that are reinvested in other debt securities. In the case of a bond with a sinking fund, the greater probability of receiving the principal repayment prior to maturity increases the expected cash flows during the bond's life and, therefore, the uncertainty about interest income on reinvested funds.

There are several coupon structures besides a fixed-coupon structure, and we summarize the most important ones here.

Floating-Rate Notes

Some bonds pay periodic interest that depends on a current market rate of interest. These bonds are called **floating-rate notes** (FRN) or **floaters**. The market rate of interest is called the **reference rate**, and an FRN promises to pay the reference rate plus some interest margin. This added margin is typically expressed in **basis points**, which are hundredths of 1%. A 120 basis point margin is equivalent to 1.2%.

As an example, consider a floating-rate note that pays the London Interbank Offered Rate (LIBOR) plus a margin of 0.75% (75 basis points) annually. If 1-year LIBOR is 2.3% at the beginning of the year, the bond will pay $2.3\% + 0.75\% = 3.05\%$ of its par value at the end of the year. The new 1-year rate at that time will determine the rate of interest paid at the end of the next year. Most floaters pay quarterly and are based on a quarterly (90-day) reference rate.

A floating-rate note may have a **cap**, which benefits the issuer by placing a limit on how high the coupon rate can rise. Often, FRNs with caps also have a **floor**, which benefits the bondholder by placing a minimum on the coupon rate (regardless of how low the reference rate falls). An **inverse floater** has a coupon rate that increases when the reference rate decreases and decreases when the reference rate increases.

Other Coupon Structures

Step-up coupon bonds are structured so that the coupon rate increases over time according to a predetermined schedule. Typically, step-up coupon bonds have a *call feature* that allows the firm to redeem the bond issue at a set price at each step-up date. If the new higher coupon rate is greater than what the market yield would be at the call price, the firm will call the bonds and retire them. This means if market yields rise, a bondholder may, in turn, get a higher coupon rate because the bonds are less likely to be called on the step-up date.

Yields could increase because an issuer's credit rating has fallen, in which case the higher step-up coupon rate simply compensates investors for greater credit risk. Aside from this, we can view step-up coupon bonds as having some protection against increases in market interest rates to the extent they are offset by increases in bond coupon rates.

A **credit-linked coupon bond** carries a provision stating that the coupon rate will go up by a certain amount if the credit rating of the issuer falls and go down if the credit rating of the issuer improves. While this offers some protection against a credit downgrade of the issuer, the higher required coupon payments may make the financial situation of the issuer worse and possibly increase the probability of default.

A **payment-in-kind (PIK) bond** allows the issuer to make the coupon payments by increasing the principal amount of the outstanding bonds, essentially paying bond interest with more bonds. Firms that issue PIK bonds typically do so because they anticipate that firm cash flows may be less than required to service the debt, often because of high levels of debt financing (leverage). These bonds typically have higher yields because of a lower perceived credit quality from cash flow shortfalls or simply because of the high leverage of the issuing firm.

With a **deferred coupon bond**, also called a **split coupon bond**, regular coupon payments do not begin until a period of time after issuance. These are issued by firms that anticipate cash flows will increase in the future to allow them to make coupon interest payments.

Deferred coupon bonds may be appropriate financing for a firm financing a large project that will not be completed and generating revenue for some period of time after bond issuance. Deferred coupon bonds may offer bondholders tax advantages in some jurisdictions. Zero-coupon bonds can be considered a type of deferred coupon bond.

An **index-linked bond** has coupon payments and/or a principal value that is based on a commodity index, an equity index, or some other published index number. **Inflation-linked bonds** (also called **linkers**) are the most common type of index-linked bonds. Their payments are based on the change in an inflation index, such as the Consumer Price Index (CPI) in the United States. Indexed bonds that will not pay less than their original par value at maturity, even when the index has decreased, are termed **principal protected bonds**.

The different structures of inflation-indexed bonds include the following:

- **Indexed-annuity bonds.** Fully amortizing bonds with the periodic payments directly adjusted for inflation or deflation.
- **Indexed zero-coupon bonds.** The payment at maturity is adjusted for inflation.
- **Interest-indexed bonds.** The coupon rate is adjusted for inflation while the principal value remains unchanged.
- **Capital-indexed bonds.** This is the most common structure. An example is U.S. Treasury Inflation Protected Securities (TIPS). The coupon rate remains constant, and the principal value of the bonds is increased by the rate of inflation (or decreased by deflation).

To better understand the structure of capital-indexed bonds, consider a bond with a par value of \$1,000 at issuance, a 3% annual coupon rate paid semiannually, and a provision that the principal value will be adjusted for inflation (or deflation). If six months after issuance the reported inflation has been 1% over the period, the principal value of the bonds is increased by 1% from \$1,000 to \$1,010, and the six-month coupon of 1.5% is calculated as 1.5% of the new (adjusted) principal value of \$1,010 (i.e., $1,010 \times 1.5\% = \$15.15$).

With this structure we can view the coupon rate of 3% as a real rate of interest. Unexpected inflation will not decrease the purchasing power of the coupon interest payments, and the principal value paid at maturity will have approximately the same purchasing power as the \$1,000 par value did at bond issuance.

LOS 42.f: Describe contingency provisions affecting the timing and/or nature of cash flows of fixed-income securities and identify whether such provisions benefit the borrower or the lender.

A **contingency provision** in a contract describes an action that may be taken if an event (the contingency) actually occurs. Contingency provisions in bond indentures are referred to as **embedded options**, embedded in the sense that they are an integral part of the bond contract and are not a separate security. Some embedded options are exercisable at the option of the issuer of the bond and, therefore, are valuable to the issuer; others are exercisable at the option of the purchaser of the bond and, thus, have value to the bondholder.

Bonds that do not have contingency provisions are referred to as **straight** or **option-free** bonds.

A **call option** gives the *issuer* the right to redeem all or part of a bond issue at a specific price (call price) if they choose to. As an example of a call provision, consider a 6% 20-year bond issued at par on June 1, 2012, for which the indenture includes the following *call schedule*:

- The bonds can be redeemed by the issuer at 102% of par after June 1, 2017.
- The bonds can be redeemed by the issuer at 101% of par after June 1, 2020.
- The bonds can be redeemed by the issuer at 100% of par after June 1, 2022.

For the 5-year period from the issue date until June 2017, the bond is not callable. We say the bond has five years of *call protection*, or that the bond is *call protected* for five years. This 5-year period is also referred to as a *lockout period*, a *cushion*, or a *deferment period*.

June 1, 2017, is referred to as the *first call date*, and the *call price* is 102 (102% of par value) between that date and June 2020. The amount by which the call price is above par is referred to as the *call premium*. The call premium at the first call date in this example is 2%, or \$20 per \$1,000 bond. The call price declines to 101 (101% of par) after June 1, 2020. After, June 1, 2022, the bond is callable at par, and that date is referred to as the *first par call date*.

For a bond that is currently callable, the call price puts an upper limit on the value of the bond in the market.

A call option has value to the issuer because it gives the issuer the right to redeem the bond and issue a new bond (borrow) if the market yield on the bond declines. This could occur either because interest rates in general have decreased or because the credit quality of the bond has increased (default risk has decreased).

Consider a situation where the market yield on the previously discussed 6% 20-year bond has declined from 6% at issuance to 4% on June 1, 2017 (the first call date). If the bond did not have a call option, it would trade at approximately \$1,224. With a call price of 102, the issuer can redeem the bonds at \$1,020 each and borrow that amount at the current market yield of 4%, reducing the annual interest payment from \$60 per bond to \$40.80.



PROFESSOR'S NOTE

This is analogous to refinancing a home mortgage when mortgage rates fall in order to reduce the monthly payments.

The issuer will only choose to exercise the call option when it is to their advantage to do so. That is, they can reduce their interest expense by calling the bond and issuing new bonds at a lower yield. Bond buyers are disadvantaged by the call provision and have more reinvestment risk because their bonds will only be called (redeemed prior to maturity) when the proceeds can be reinvested only at a lower yield. For this reason, a callable bond must offer a higher

yield (sell at a lower price) than an otherwise identical noncallable bond. The difference in price between a callable bond and an otherwise identical noncallable bond is equal to the value of the call option to the issuer.

There are three *styles of exercise* for callable bonds:

1. American style—the bonds can be called anytime after the first call date.
2. European style—the bonds can only be called on the call date specified.
3. Bermuda style—the bonds can be called on specified dates after the first call date, often on coupon payment dates.

Note that these are only style names and are not indicative of where the bonds are issued.

To avoid the higher interest rates required on callable bonds but still preserve the option to redeem bonds early when corporate or operating events require it, issuers introduced bonds with **make-whole** call provisions. With a make-whole bond, the call price is not fixed but includes a lump-sum payment based on the present value of the future coupons the bondholder will not receive if the bond is called early.

With a make-whole call provision, the calculated call price is unlikely to be lower than the market value of the bond. Therefore the issuer is unlikely to call the bond except when corporate circumstances, such as an acquisition or restructuring, require it. The make-whole provision does not put an upper limit on bond values when interest rates fall as does a regular call provision. The make-whole provision actually penalizes the issuer for calling the bond. The net effect is that the bond can be called if necessary, but it can also be issued at a lower yield than a bond with a traditional call provision.

Putable Bonds

A **put option** gives the *bondholder* the right to sell the bond back to the issuing company at a prespecified price, typically par. Bondholders are likely to exercise such a put option when the fair value of the bond is less than the put price because interest rates have risen or the credit quality of the issuer has fallen. Exercise styles used are similar to those we enumerated for callable bonds.

Unlike a call option, a put option has value to the bondholder because the choice of whether to exercise the option is the bondholder's. For this reason, a puttable bond will sell at a higher price (offer a lower yield) compared to an otherwise identical option-free bond.

Convertible Bonds

Convertible bonds, typically issued with maturities of 5–10 years, give bondholders the option to exchange the bond for a specific number of shares of the issuing corporation's common stock. This gives bondholders the opportunity to profit from increases in the value of the common shares. Regardless of the price of the common shares, the value of a convertible bond will be at least equal to its bond value without the conversion option. Because the conversion option is valuable to bondholders, convertible bonds can be issued with lower yields compared to otherwise identical straight bonds.

Essentially, the owner of a convertible bond has the downside protection (compared to equity shares) of a bond, but at a reduced yield, and the upside opportunity of equity shares. For this reason convertible bonds are often referred to as a *hybrid security*—part debt and part equity.

To issuers, the advantages of issuing convertible bonds are a lower yield (interest cost) compared to straight bonds and the fact that debt financing is converted to equity financing when the bonds are converted to common shares. Some terms related to convertible bonds are:

- **Conversion price.** The price per share at which the bond (at its par value) may be converted to common stock.
- **Conversion ratio.** Equal to the par value of the bond divided by the conversion price. If a bond with a \$1,000 par value has a conversion price of \$40, its *conversion ratio* is $1,000 / 40 = 25$ shares per bond.
- **Conversion value.** This is the market value of the shares that would be received upon conversion. A bond with a conversion ratio of 25 shares when the current market price of a common share is \$50 would have a conversion value of $25 \times 50 = \$1,250$.

Even if the share price increases to a level where the conversion value is significantly above the bond's par value, bondholders might not convert the bonds to common stock until they must because the interest yield on the bonds is higher than the dividend yield on the common shares received through conversion. For this reason, many convertible bonds have a call provision. Because the call price will be less than the conversion value of the shares, by exercising their call provision, the issuers can force bondholders to exercise their conversion option when the conversion value is significantly above the par value of the bonds.

Warrants

An alternative way to give bondholders an opportunity for additional returns when the firm's common shares increase in value is to include **warrants** with straight bonds when they are issued. Warrants give their holders the right to buy the firm's common shares at a given price over a given period of time. As an example, warrants that give their holders the right to buy shares for \$40 will provide profits if the common shares increase in value above \$40 prior to expiration of the warrants. For a young firm, issuing debt can be difficult because the downside (probability of firm failure) is significant, and the upside is limited to the promised debt payments. Including warrants, which are sometimes referred to as a "sweetener," makes the debt more attractive to investors because it adds potential upside profits if the common shares increase in value.

Contingent Convertible Bonds

Contingent convertible bonds (referred to as *CoCos*) are bonds that convert from debt to common equity automatically if a specific event occurs. This type of bond has been issued by some European banks. Banks must maintain specific levels of equity financing. If a bank's equity falls below the required level, they must somehow raise more equity financing to comply with regulations. CoCos are often structured so that if the bank's equity capital falls below a given level, they are automatically converted to common stock. This has the effect of decreasing the bank's debt liabilities and increasing its equity capital at the same time, which helps the bank to meet its minimum equity requirement.



MODULE QUIZ 42.2

To best evaluate your performance, enter your quiz answers online.

1. A 10-year bond pays no interest for three years, then pays \$229.25, followed by payments of \$35 semiannually for seven years, and an additional \$1,000 at maturity. This bond is:

- A. a step-up bond.
 - B. a zero-coupon bond.
 - C. a deferred-coupon bond.
2. Which of the following statements is *most accurate* with regard to floating-rate issues that have caps and floors?
- A. A cap is an advantage to the bondholder, while a floor is an advantage to the issuer.
 - B. A floor is an advantage to the bondholder, while a cap is an advantage to the issuer.
 - C. A floor is an advantage to both the issuer and the bondholder, while a cap is a disadvantage to both the issuer and the bondholder.
3. Which of the following *most accurately* describes the maximum price for a currently callable bond?
- A. Its par value.
 - B. The call price.
 - C. The present value of its par value.

KEY CONCEPTS

LOS 42.a

Basic features of a fixed income security include the issuer, maturity date, par value, coupon rate, coupon frequency, and currency.

- Issuers include corporations, governments, quasi-government entities, and supranational entities.
- Bonds with original maturities of one year or less are money market securities. Bonds with original maturities of more than one year are capital market securities.
- Par value is the principal amount that will be repaid to bondholders at maturity. Bonds are trading at a premium if their market price is greater than par value or trading at a discount if their price is less than par value.
- Coupon rate is the percentage of par value that is paid annually as interest. Coupon frequency may be annual, semiannual, quarterly, or monthly. Zero-coupon bonds pay no coupon interest and are pure discount securities.
- Bonds may be issued in a single currency, dual currencies (one currency for interest and another for principal), or with a bondholder's choice of currency.

LOS 42.b

A bond indenture or trust deed is a contract between a bond issuer and the bondholders, which defines the bond's features and the issuer's obligations. An indenture specifies the entity issuing the bond, the source of funds for repayment, assets pledged as collateral, credit enhancements, and any covenants with which the issuer must comply.

LOS 42.c

Covenants are provisions of a bond indenture that protect the bondholders' interests. Negative covenants are restrictions on a bond issuer's operating decisions, such as prohibiting the issuer from issuing additional debt or selling the assets pledged as collateral. Affirmative covenants are administrative actions the issuer must perform, such as making the interest and principal payments on time.

LOS 42.d

Legal and regulatory matters that affect fixed income securities include the places where they are issued and traded, the issuing entities, sources of repayment, and collateral and credit enhancements.

- Domestic bonds trade in the issuer's home country and currency. Foreign bonds are from foreign issuers but denominated in the currency of the country where they trade. Eurobonds are issued outside the jurisdiction of any single country and denominated in a currency other than that of the countries in which they trade.
- Issuing entities may be a government or agency; a corporation, holding company, or subsidiary; or a special purpose entity.
- The source of repayment for sovereign bonds is the country's taxing authority. For non-sovereign government bonds, the sources may be taxing authority or revenues from a project. Corporate bonds are repaid with funds from the firm's operations. Securitized bonds are repaid with cash flows from a pool of financial assets.

- Bonds are secured if they are backed by specific collateral or unsecured if they represent an overall claim against the issuer's cash flows and assets.
- Credit enhancement may be internal (overcollateralization, excess spread, tranches with different priority of claims) or external (surety bonds, bank guarantees, letters of credit).

Interest income is typically taxed at the same rate as ordinary income, while gains or losses from selling a bond are taxed at the capital gains tax rate. However, the increase in value toward par of original issue discount bonds is considered interest income. In the United States, interest income from municipal bonds is usually tax-exempt at the national level and in the issuer's state.

LOS 42.e

A bond with a bullet structure pays coupon interest periodically and repays the entire principal value at maturity.

A bond with an amortizing structure repays part of its principal at each payment date. A fully amortizing structure makes equal payments throughout the bond's life. A partially amortizing structure has a balloon payment at maturity, which repays the remaining principal as a lump sum.

A sinking fund provision requires the issuer to retire a portion of a bond issue at specified times during the bonds' life.

Floating-rate notes have coupon rates that adjust based on a reference rate such as LIBOR.

Other coupon structures include step-up coupon notes, credit-linked coupon bonds, payment-in-kind bonds, deferred coupon bonds, and index-linked bonds.

LOS 42.f

Embedded options benefit the party who has the right to exercise them. Call options benefit the issuer, while put options and conversion options benefit the bondholder.

Call options allow the issuer to redeem bonds at a specified call price.

Put options allow the bondholder to sell bonds back to the issuer at a specified put price.

Conversion options allow the bondholder to exchange bonds for a specified number of shares of the issuer's common stock.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 42.1

1. **C** Dual-currency bonds pay coupon interest in one currency and principal in a different currency. These currencies may or may not include the home currency of the issuer. A currency option bond allows the bondholder to choose a currency in which to be paid. (LOS 42.a)
2. **A** An indenture is the contract between the company and its bondholders and contains the bond's covenants. (LOS 42.b)
3. **C** Affirmative covenants require the borrower to perform certain actions. Negative covenants restrict the borrower from performing certain actions. Trust deed is another name for a bond indenture. (LOS 42.c)
4. **B** Tax authorities typically treat the increase in value of a pure-discount bond toward par as interest income to the bondholder. In many jurisdictions this interest income is taxed periodically during the life of the bond even though the bondholder does not receive any cash until maturity. (LOS 42.d)

Module Quiz 42.2

1. **C** This pattern describes a deferred-coupon bond. The first payment of \$229.25 is the value of the accrued coupon payments for the first three years. (LOS 42.e)
2. **B** A cap is a maximum on the coupon rate and is advantageous to the issuer. A floor is a minimum on the coupon rate and is, therefore, advantageous to the bondholder. (LOS 42.e)
3. **B** Whenever the price of the bond increases above the strike price stipulated on the call option, it will be optimal for the issuer to call the bond. Theoretically, the price of a currently callable bond should never rise above its call price. (LOS 42.f)

The following is a review of the Fixed Income (1) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #43.

READING 43: FIXED-INCOME MARKETS: ISSUANCE, TRADING, AND FUNDING

Study Session 14

EXAM FOCUS

This topic review introduces many terms and definitions. Focus on different types of issuers, features of the various debt security structures, and why different sources of funds have different interest costs. Understand well the differences between fixed-rate and floating-rate debt and how rates are determined on floating-rate debt and for repurchase agreements.

MODULE 43.1: TYPES OF BONDS AND ISSUERS



LOS 43.a: Describe classifications of global fixed-income markets.

Video covering this content is available online.

CFA[®] Program Curriculum: Volume 5, page 56

Global bond markets can be classified by several bond characteristics, including type of issuer, credit quality, maturity, coupon, currency, geography, indexing, and taxable status.

Type of issuer. Common classifications are households, nonfinancial corporations, governments, and financial institutions. In developed markets, the largest issuers by total value of bonds outstanding in global markets are financial corporations and governments. In emerging markets, nonfinancial corporations are the largest issuers.

Credit quality. Standard & Poor's (S&P), Moody's, and Fitch all provide credit ratings on bonds. For S&P and Fitch, the highest bond ratings are AAA, AA, A, and BBB, and are considered *investment grade bonds*. The equivalent ratings by Moody's are Aaa through Baa3. Bonds BB+ or lower (Ba1 or lower) are termed high-yield, speculative, or "junk" bonds. Some institutions are prohibited from investing in bonds of less than investment grade.

Original maturities. Securities with original maturities of one year or less are classified as **money market securities**. Examples include U.S. Treasury bills, commercial paper (issued by corporations), and negotiable certificates of deposit, or CDs (issued by banks). Securities with original maturities greater than one year are referred to as **capital market securities**.

Coupon structure. Bonds are classified as either floating-rate or fixed-rate bonds, depending on whether their coupon interest payments are stated in the bond indenture or depend on the level of a short-term market *reference rate* determined over the life of the bond. Purchasing floating-rate debt is attractive to some institutions that have variable-rate sources of funds (liabilities), such as banks. This allows these institutions to avoid the balance sheet effects of interest rate increases that would increase the cost of funds but leave the interest income at a fixed rate. The value of fixed-rate bonds (assets) held would fall in the value, while the value of their liabilities would be much less affected.

Currency denomination. A bond's price and returns are determined by the interest rates in the bond's currency. The majority of bonds issued are denominated in either U.S. dollars or euros.

Geography. Bonds may be classified by the markets in which they are issued. Recall the discussion in the previous topic review of domestic (or national) bond markets, foreign bonds, and eurobonds, and the differences among them. Bond markets may also be classified as **developed markets** or **emerging markets**. Emerging markets are countries whose capital markets are less well-established than those in developed markets. Emerging market bonds are typically viewed as riskier than developed market bonds and therefore have higher yields.

Indexing. As discussed previously, the cash flows on some bonds are based on an index (**index-linked bonds**). Bonds with cash flows determined by inflation rates are referred to as inflation-indexed or inflation-linked bonds. Inflation-linked bonds are issued primarily by governments but also by some corporations of high credit quality.

Tax status. In various countries, some issuers may issue bonds that are exempt from income taxes. In the United States, these bonds can be issued by municipalities and are called **municipal bonds**, or **munis**.

LOS 43.b: Describe the use of interbank offered rates as reference rates in floating-rate debt.

CFA® Program Curriculum: Volume 5, page 59

The most widely used reference rate for floating-rate bonds is the London Interbank Offered Rate (LIBOR), although other reference rates, such as Euribor, are also used. LIBOR rates are published daily for several currencies and for maturities of one day (overnight rates) to one year. Thus, there is no single "LIBOR rate" but rather a set of rates, such as "30-day U.S. dollar LIBOR" or "90-day Swiss franc LIBOR," all expressed as annual rates.

The rates are based on expected rates for unsecured loans from one bank to another in the **interbank money market**. An average is calculated from a survey of 18 banks' expected borrowing rates in the interbank market, after excluding the highest and lowest quotes.

For floating-rate bonds, the reference rate must match the frequency with which the coupon rate on the bond is reset. For example, a bond denominated in euros with a coupon rate that is reset twice each year might use 6-month euro LIBOR or 6-month Euribor as a reference rate.

The fact that LIBOR is not based on actual transactions, and has been subject to manipulation by bankers reporting their expected interbank lending rates, has led to an effort to replace LIBOR with market-determined rates. It has been agreed that by the end of 2021, banks will no longer be required to report the estimated rates that are used to determine LIBOR. Thus, alternatives to LIBOR must be found for each of the various currencies involved. In the United States, the new rate will likely be the structured overnight financing rate (SOFR), which is based on the actual rates of repurchase (repo) transactions and reported daily by the Federal Reserve.

LOS 43.c: Describe mechanisms available for issuing bonds in primary markets.

CFA® Program Curriculum: Volume 5, page 66

Sales of newly issued bonds are referred to as **primary market** transactions. Newly issued bonds can be registered with securities regulators for sale to the public, a **public offering**, or sold only to qualified investors, a **private placement**.

A public offering of bonds in the primary market is typically done with the help of an investment bank. The investment bank has expertise in the various steps of a public offering, including:

- Determining funding needs.
- Structuring the debt security.
- Creating the bond indenture.
- Naming a bond trustee (a trust company or bank trust department).
- Registering the issue with securities regulators.
- Assessing demand and pricing the bonds given market conditions.
- Selling the bonds.

Bonds can be sold through an **underwritten offering** or a **best efforts offering**. In an underwritten offering, the entire bond issue is purchased from the issuing firm by the investment bank, termed the underwriter in this case. While smaller bond issues may be sold by a single investment bank, for larger issues, the *lead underwriter* heads a **syndicate** of investment banks who collectively establish the pricing of the issue and are responsible for selling the bonds to dealers, who in turn sell them to investors. The syndicate takes the risk that the bonds will not all be sold.

A new bond issue is publicized and dealers indicate their interest in buying the bonds, which provides information about appropriate pricing. Some bonds are traded on a *when issued* basis in what is called the **grey market**. Such trading prior to the offering date of the bonds provides additional information about the demand for and market clearing price (yield) for the new bond issue.

In a *best efforts* offering, the investment banks sell the bonds on a commission basis. Unlike an underwritten offering, the investment banks do not commit to purchase the whole issue (i.e., underwrite the issue).

Some bonds, especially government bonds, are sold through an auction.



PROFESSOR'S NOTE

Recall that auction procedures were explained in detail in the prerequisite readings for Economics.

U.S. Treasury securities are sold through single price auctions with the majority of purchases made by **primary dealers** that participate in purchases and sales of bonds with the Federal Reserve Bank of New York to facilitate the open market operations of the Fed. Individuals can purchase U.S. Treasury securities through the periodic auctions as well, but are a small part of the total.

In a **shelf registration**, a bond issue is registered with securities regulators in its aggregate value with a master prospectus. Bonds can then be issued over time when the issuer needs to raise funds. Because individual offerings under a shelf registration require less disclosure than a separate registration of a bond issue, only financially sound companies are granted this option. In some countries, bonds registered under a shelf registration can be sold only to qualified investors.

LOS 43.d: Describe secondary markets for bonds.

CFA® Program Curriculum: Volume 5, page 70

Secondary markets refer to the trading of previously issued bonds. While some government bonds and corporate bonds are traded on exchanges, the great majority of bond trading in the secondary market is made in the dealer, or over-the-counter, market. Dealers post bid (purchase) prices and ask or offer (selling) prices for various bond issues. The difference between the bid and ask prices is the dealer's spread. The average spread is often between 10 and 12 basis points but varies across individual bonds according to their liquidity and may be more than 50 basis points for an illiquid issue.¹

Bond trades are cleared through a clearing system, just as equities trades are. Settlement (the exchange of bonds for cash) for government bonds is either the day of the trade (cash settlement) or the next business day ($T + 1$). Corporate bonds typically settle on $T + 2$ or $T + 3$, although in some markets it is longer.

LOS 43.e: Describe securities issued by sovereign governments.

CFA® Program Curriculum: Volume 5, page 73

National governments or their treasuries issue bonds backed by the taxing power of the government that are referred to as **sovereign bonds**. Bonds issued in the currency of the issuing government carry high credit ratings and are considered to be essentially free of default risk. Both a sovereign's ability to collect taxes and its ability to print the currency support these high credit ratings.

Sovereign nations also issue bonds denominated in currencies different from their own. Credit ratings are often higher for a sovereign's local currency bonds than for example, its euro or U.S. dollar-denominated bonds. This is because the national government cannot print the developed market currency and the developed market currency value of local currency tax collections is dependent on the exchange rate between the two currencies.

Trading is most active and prices most informative for the most recently issued government securities of a particular maturity. These issues are referred to as **on-the-run** bonds and also as **benchmark** bonds because the yields of other bonds are determined relative to the "benchmark" yields of sovereign bonds of similar maturities.

Sovereign governments issue fixed-rate, floating-rate, and inflation-indexed bonds.

LOS 43.f: Describe securities issued by non-sovereign governments, quasi-government entities, and supranational agencies.

CFA® Program Curriculum: Volume 5, page 77

Non-sovereign government bonds are issued by states, provinces, counties, and sometimes by entities created to fund and provide services such as for the construction of hospitals, airports, and other municipal services. Payments on the bonds may be supported by the revenues of a specific project, from general tax revenues, or from special taxes or fees dedicated to the repayment of project debt.

Non-sovereign bonds are typically of high credit quality, but sovereign bonds typically trade with lower yields (higher prices) because their credit risk is perceived to be less than that of

non-sovereign bonds.



PROFESSOR'S NOTE

We will examine the credit quality of sovereign and non-sovereign government bonds in our topic review of “Fundamentals of Credit Analysis.”

Agency or **quasi-government** bonds are issued by entities created by national governments for specific purposes such as financing small businesses or providing mortgage financing. In the United States, bonds are issued by government-sponsored enterprises (GSEs), such as the Federal National Mortgage Association and the Tennessee Valley Authority.

Some quasi-government bonds are backed by the national government, which gives them high credit quality. Even those not backed by the national government typically have high credit quality although their yields are marginally higher than those of sovereign bonds.

Supranational bonds are issued by supranational agencies, also known as *multilateral agencies*. Examples are the World Bank, the IMF, and the Asian Development Bank. Bonds issued by supranational agencies typically have high credit quality and can be very liquid, especially large issues of well-known entities.



MODULE QUIZ 43.1

To best evaluate your performance, enter your quiz answers online.

1. An analyst who describes a fixed-income security as being a structured finance instrument is classifying the security by:
 - A. credit quality.
 - B. type of issuer.
 - C. taxable status.
2. LIBOR rates are determined:
 - A. by countries' central banks.
 - B. by money market regulators.
 - C. in the interbank lending market.
3. In which type of primary market transaction does an investment bank sell bonds on a commission basis?
 - A. Single-price auction.
 - B. Best-efforts offering.
 - C. Underwritten offering.
4. Secondary market bond transactions *most likely* take place:
 - A. in dealer markets.
 - B. in brokered markets.
 - C. on organized exchanges.
5. Sovereign bonds are described as on-the-run when they:
 - A. are the most recent issue in a specific maturity.
 - B. have increased substantially in price since they were issued.
 - C. receive greater-than-expected demand from auction bidders.
6. Bonds issued by the World Bank would *most likely* be:
 - A. quasi-government bonds.
 - B. global bonds.
 - C. supranational bonds.

MODULE 43.2: CORPORATE DEBT AND FUNDING ALTERNATIVES



Video covering this content is available online.

LOS 43.g: Describe types of debt issued by corporations.

CFA® Program Curriculum: Volume 5, page 79

Bank Debt

Most corporations fund their businesses to some extent with bank loans. These are typically LIBOR-based, variable-rate loans. When the loan involves only one bank, it is referred to as a **bilateral loan**. In contrast, when a loan is funded by several banks, it is referred to as a **syndicated loan** and the group of banks is the syndicate. There is a secondary market in syndicated loan interests that are also securitized, creating bonds that are sold to investors.

Commercial Paper

For larger creditworthy corporations, funding costs can be reduced by issuing short-term debt securities referred to as **commercial paper**. For these firms, the interest cost of commercial paper is less than the interest on a bank loan. Commercial paper yields more than short-term sovereign debt because it has, on average, more credit risk and less liquidity.

Firms use commercial paper to fund working capital and as a temporary source of funds prior to issuing longer-term debt. Debt that is temporary until permanent financing can be secured is referred to as **bridge financing**.

Commercial paper is a short-term, unsecured debt instrument. In the United States, commercial paper is issued with maturities of 270 days or less, because debt securities with maturities of 270 days or less are exempt from SEC registration. Eurocommercial paper (ECP) is issued in several countries with maturities as long as 364 days. Commercial paper is issued with maturities as short as one day (overnight paper), with most issues maturing in about 90 days.

Commercial paper is often reissued or *rolled over* when it matures. The risk that a company will not be able to sell new commercial paper to replace maturing paper is termed *rollover risk*. The two important circumstances in which a company will face rollover difficulties are (1) there is a deterioration in a company's actual or perceived ability to repay the debt at maturity, which will significantly increase the required yield on the paper or lead to less-than-full subscription to a new issue, and (2) significant systemic financial distress, as was experienced in the 2008 financial crisis, that may "freeze" debt markets so that very little commercial paper can be sold at all.

In order to get an acceptable credit rating from the ratings services on their commercial paper, corporations maintain **backup lines of credit** with banks. These are sometimes referred to as *liquidity enhancement* or *backup liquidity lines*. The bank agrees to provide the funds when the paper matures, if needed, except in the case of a *material adverse change* (i.e., when the company's financial situation has deteriorated significantly).

Similar to U.S. T-bills, commercial paper in the United States is typically issued as a pure discount security, making a single payment equal to the face value at maturity. Prices are quoted as a percentage discount from face value. In contrast, ECP rates may be quoted as either a discount yield or an *add-on yield*, that is, the percentage interest paid at maturity in addition to the par value of the commercial paper. As an example, consider 240-day commercial paper with a holding period yield of 1.35%. If it is quoted with a discount yield,

it will be issued at $100 / 1.0135 = 98.668$ and pay 100 at maturity. If it is quoted with an add-on yield, it will be issued at 100 and pay 101.35 at maturity.

Corporate Bonds

In the previous topic review, we discussed several features of corporate bonds. **Corporate bonds** are issued with various coupon structures and with both fixed-rate and floating-rate coupon payments. They may be secured by collateral or unsecured and may have call, put, or conversion provisions.

We also discussed a sinking fund provision as a way to reduce the credit risk of a bond by redeeming part of the bond issue periodically over a bond's life. An alternative to a sinking fund provision is to issue a **serial bond issue**. With a serial bond issue, bonds are issued with several maturity dates so that a portion of the issue is redeemed periodically. An important difference between a serial bond issue and an issue with a sinking fund is that with a serial bond issue, investors know at issuance when specific bonds will be redeemed. A bond issue that does not have a serial maturity structure is said to have a **term maturity structure** with all the bonds maturing on the same date.

In general, corporate bonds are referred to as short-term if they are issued with maturities of up to 5 years, medium-term when issued with maturities from 5 to 12 years, and long-term when maturities exceed 12 years.

Corporations issue debt securities called **medium-term notes** (MTNs), which are not necessarily medium-term in maturity. MTNs are issued in various maturities, ranging from nine months to periods as long as 100 years. Issuers provide *maturity ranges* (e.g., 18 months to two years) for MTNs they wish to sell and provide yield quotes for those ranges. Investors interested in purchasing the notes make an offer to the issuer's agent, specifying the face value and an exact maturity within one of the ranges offered. The agent then confirms the issuer's willingness to sell those MTNs and effects the transaction.

MTNs can have fixed- or floating-rate coupons, but longer-maturity MTNs are typically fixed-rate bonds. Most MTNs, other than long-term MTNs, are issued by financial corporations and most buyers are financial institutions. MTNs can be structured to meet an institution's specifications. While custom bond issues have less liquidity, they provide slightly higher yields compared to an issuer's publicly traded bonds.

LOS 43.h: Describe structured financial instruments.

CFA® Program Curriculum: Volume 5, page 87

Structured financial instruments are securities designed to change the risk profile of an underlying debt security, often by combining a debt security with a derivative. Sometimes structured financial instruments redistribute risk. Examples of this type of structured instruments are asset-backed securities and collateralized debt obligations. Both of these types of structured securities are discussed in some detail in our review of asset-backed securities.

Here, we describe several other types of structured instruments with which candidates should be familiar.

1. Yield enhancement instruments

A **credit-linked note (CLN)** has regular coupon payments, but its redemption value depends on whether a specific credit event occurs. If the credit event (e.g., a credit rating downgrade or default of a reference asset) does not occur, the CLN will be redeemed at its par value. If the credit event occurs, the CLN will make a lower redemption payment. Thus, the realized yield on a CLN will be lower if the credit event occurs. Purchasing a CLN can be viewed as buying a note and simultaneously selling a credit default swap (CDS), a derivative security. The buyer of a CDS makes periodic payments to the seller, who will make a payment to the buyer if a specified credit event occurs. The yield on a CLN is higher than it would be on the note alone, without the credit link. This extra yield compensates the buyer of the note (seller of the CDS) for taking on the credit risk of the reference asset, which is why we classify CLNs as a yield enhancement instrument.

2. Capital protected instruments

A capital protected instrument offers a guarantee of a minimum value at maturity as well as some potential upside gain. An example is a security that promises to pay \$1,000 at maturity plus a percentage of any gains on a specified stock index over the life of the security. Such a security could be created by combining a zero-coupon bond selling for \$950 that matures at \$1,000 in 1 year, with a 1-year call option on the reference stock index with a cost of \$50. The total cost of the security is \$1,000, and the minimum payoff at maturity (if the call option expires with a value of zero) is \$1,000. If the call option has a positive value at maturity, the total payment at maturity is greater than \$1,000. A structured financial instrument that promises the \$1,000 payment at maturity under this structure is called a **guarantee certificate**, because the guaranteed payoff is equal to the initial cost of the structured security. Capital protected instruments that promise a payment at maturity less than the initial cost of the instrument offer less-than-full protection, but greater potential for upside gains because more calls can be purchased.

3. Participation instruments

A participation instrument has payments that are based on the value of an underlying instrument, often a reference interest rate or equity index. Participation instruments do not offer capital protection. One example of a participation instrument is a floating-rate note. With a floating-rate note, the coupon payments are based on the value of a short-term interest rate, such as 90-day LIBOR (the reference rate). When the reference rate increases, the coupon payment increases. Because the coupon payments move with the reference rates on floating-rate securities, their market values remain relatively stable, even when interest rates change.

Participation is often based on the performance of an equity price, an equity index value, or the price of another asset. Fixed-income portfolio managers who are only permitted to invest in “debt” securities can use participation instruments to gain exposure to returns on an equity index or asset price.

4. Leveraged instruments

An **inverse floater** is an example of a leveraged instrument. An inverse floater has coupon payments that increase when a reference rate decreases and decrease when a reference rate increases, the opposite of coupon payments on a floating-rate note. A simple structure might promise to pay a coupon rate, C , equal to a specific rate minus a reference rate, for example, $C = 6\% - 180\text{-day LIBOR}$. When 180-day LIBOR increases, the coupon rate on the inverse floater decreases.

Inverse floaters can also be structured with leverage so that the change in the coupon rate is some multiple of the change in the reference rate. As an example, consider a note with $C = 6\% - (1.2 \times 90\text{-day LIBOR})$ so that the coupon payment rate changes by 1.2 times the change in the reference rate. Such a floater is termed a **leveraged inverse floater**. When the multiplier on the reference rate is less than one, such as $7\% - (0.5 \times 180\text{-day LIBOR})$, the instrument is termed a **deleveraged inverse floater**. In either case, a minimum or floor rate for the coupon rate, often 0%, is specified for the inverse floater.

LOS 43.i: Describe short-term funding alternatives available to banks.

CFA® Program Curriculum: Volume 5, page 90

Customer deposits (retail deposits) are a short-term funding source for banks. Checking accounts provide transactions services and immediate availability of funds but typically pay no interest. Money market mutual funds and savings accounts provide less liquidity or less transactions services, or both, and pay periodic interest.

In addition to funds from retail accounts, banks offer interest-bearing **certificates of deposit** (CDs) that mature on specific dates and are offered in a range of short-term maturities. Nonnegotiable CDs cannot be sold and withdrawal of funds often incurs a significant penalty.

Negotiable certificates of deposit can be sold. At the wholesale level, large denomination (typically more than \$1 million) negotiable CDs are an important funding source for banks. They typically have maturities of one year or less and are traded in domestic bond markets as well as in the Eurobond market.

Another source of short-term funding for banks is to borrow excess reserves from other banks in the **central bank funds market**. Banks in most countries must maintain a portion of their funds as reserves on deposit with the central bank. At any point in time, some banks may have more than the required amount of reserves on deposit, while others require more reserve deposits. In the market for central bank funds, banks with excess reserves lend them to other banks for periods of one day (overnight funds) and for longer periods up to a year (term funds). **Central bank funds rates** refer to rates for these transactions, which are strongly influenced by the effect of the central bank's open market operations on the money supply and availability of short-term funds.

In the United States, the central bank funds rate is called the Fed funds rate and this rate influences the interest rates of many short-term debt securities.

Other than reserves on deposit with the central bank, funds that are loaned by one bank to another are referred to as **interbank funds**. Interbank funds are loaned between banks for periods of one day to a year. These loans are unsecured and, as with many debt markets, liquidity may decrease severely during times of systemic financial distress.

LOS 43.j: Describe repurchase agreements (repos) and the risks associated with them.

CFA® Program Curriculum: Volume 5, page 92

A **repurchase (repo) agreement** is an arrangement by which one party sells a security to a counterparty with a commitment to buy it back at a later date at a specified (higher) price. The *repurchase price* is greater than the selling price and accounts for the interest charged by the buyer, who is, in effect, lending funds to the seller with the security as collateral. The

interest rate implied by the two prices is called the *repo rate*, which is the annualized percentage difference between the two prices. A repurchase agreement for one day is called an *overnight repo* and an agreement covering a longer period is called a *term repo*. The interest cost of a repo is customarily less than the rate on bank loans or other short-term borrowing.

As an example, consider a firm that enters into a repo agreement to sell a 4%, 12-year bond with a par value of \$1 million and a market value of \$970,000 for \$940,000 and to repurchase it 90 days later (the **repo date**) for \$947,050.

The implicit interest rate for the 90-day loan period is $947,050 / 940,000 - 1 = 0.75\%$ and the *repo rate* would be expressed as the equivalent annual rate.

The percentage difference between the market value and the amount loaned is called the **repo margin** or the **haircut**. In our example, it is $940,000 / 970,000 - 1 = -3.1\%$. This margin protects the lender in the event that the value of the security decreases over the term of the repo agreement.

The repo rate is:

- Higher, the longer the repo term.
- Lower, the higher the credit quality of the collateral security.
- Lower when the collateral security is delivered to the lender.
- Higher when the interest rates for alternative sources of funds are higher.

The repo margin is influenced by similar factors. The repo margin is:

- Higher, the longer the repo term.
- Lower, the higher the credit quality of the collateral security.
- Lower, the higher the credit quality of the borrower.
- Lower when the collateral security is in high demand or low supply.

The reason the supply and demand conditions for the collateral security affects pricing is that some lenders want to own a specific bond or type of bond as collateral. For a bond that is high demand, lenders must compete for bonds by offering lower repo lending rates.

Viewed from the standpoint of a bond dealer, a **reverse repo agreement** refers to taking the opposite side of a repurchase transaction, lending funds by buying the collateral security rather than selling the collateral security to borrow funds.



MODULE QUIZ 43.2

To best evaluate your performance, enter your quiz answers online.

1. With which of the following features of a corporate bond issue does an investor *most likely* face the risk of redemption prior to maturity?
 - A. Serial bonds.
 - B. Sinking fund.
 - C. Term maturity structure.
2. A financial instrument is structured such that cash flows to the security holder increase if a specified reference rate increases. This structured financial instrument is *best* described as:
 - A. a participation instrument.
 - B. a capital protected instrument.
 - C. a yield enhancement instrument.

3. Smith Bank lends Johnson Bank excess reserves on deposit with the central bank for a period of three months. Is this transaction said to occur in the interbank market?
 - A. Yes.
 - B. No, because the interbank market refers to loans for more than one year.
 - C. No, because the interbank market does not include reserves at the central bank.
4. In a repurchase agreement, the percentage difference between the repurchase price and the amount borrowed is *most accurately* described as:
 - A. the haircut.
 - B. the repo rate.
 - C. the repo margin.

KEY CONCEPTS

LOS 43.a

Global bond markets can be classified by the following:

- **Type of issuer:** Households, nonfinancial corporations, governments, financial institutions.
- **Credit quality:** Investment grade, noninvestment grade.
- **Original maturity:** Money market (one year or less), capital market (more than one year).
- **Coupon:** Fixed rate, floating rate.
- **Currency and geography:** Domestic, foreign, global, eurobond markets; developed, emerging markets.
- **Other classifications:** Indexing, taxable status.

LOS 43.b

Interbank lending rates, such as London Interbank Offered Rate (LIBOR), are frequently used as reference rates for floating-rate debt. An appropriate reference rate is one that matches a floating-rate note's currency and frequency of rate resets, such as 6-month U.S. dollar LIBOR for a semiannual floating-rate note issued in U.S. dollars.

LOS 43.c

Bonds may be issued in the primary market through a public offering or a private placement.

A public offering using an investment bank may be underwritten, with the investment bank or syndicate purchasing the entire issue and selling the bonds to dealers; or on a best-efforts basis, in which the investment bank sells the bonds on commission. Public offerings may also take place through auctions, which is the method commonly used to issue government debt.

A private placement is the sale of an entire issue to a qualified investor or group of investors, which are typically large institutions.

LOS 43.d

Bonds that have been issued previously trade in secondary markets. While some bonds trade on exchanges, most are traded in dealer markets. Spreads between bid and ask prices are narrower for liquid issues and wider for less liquid issues.

Trade settlement is typically $T + 2$ or $T + 3$ for corporate bonds and either cash settlement or $T + 1$ for government bonds.

LOS 43.e

Sovereign bonds are issued by national governments and backed by their taxing power. Sovereign bonds may be denominated in the local currency or a foreign currency.

LOS 43.f

Non-sovereign government bonds are issued by governments below the national level, such as provinces or cities, and may be backed by taxing authority or revenues from a specific project.

Agency or quasi-government bonds are issued by government sponsored entities and may be explicitly or implicitly backed by the government.

Supranational bonds are issued by multilateral agencies that operate across national borders.

LOS 43.g

Debt issued by corporations includes bank debt, commercial paper, corporate bonds, and medium-term notes.

Bank debt includes bilateral loans from a single bank and syndicated loans from multiple banks.

Commercial paper is a money market instrument issued by corporations of high credit quality.

Corporate bonds may have a term maturity structure (all bonds in an issue mature at the same time) or a serial maturity structure (bonds in an issue mature on a predetermined schedule) and may have a sinking fund provision.

Medium-term notes are corporate issues that can be structured to meet the requirements of investors.

LOS 43.h

Structured financial instruments include asset-backed securities and collateralized debt securities as well as the following types:

- Yield enhancement instruments include credit linked notes, which are redeemed at an amount less than par value if a specified credit event occurs on a reference asset, or at par if it does not occur. The buyer receives a higher yield for bearing the credit risk of the reference asset.
- Capital protected instruments offer a guaranteed payment, which may be equal to the purchase price of the instrument, along with participation in any increase in the value of an equity, an index, or other asset.
- Participation instruments are debt securities with payments that depend on the returns on an asset or index, or depend on a reference interest rate. One example is a floating rate bond, which makes coupon payments that change with a short-term reference rate, such as LIBOR. Other participation instruments make coupon payments based on the returns on an index of equity securities or on some other asset.
- An inverse floater is a leveraged instrument that has a coupon rate that varies inversely with a specified reference interest rate, for example, $6\% - (L \times 180\text{-day LIBOR})$. L is the leverage of the inverse floater. An inverse floater with $L > 1$, so that the coupon rate changes by more than the reference rate, is termed a leveraged inverse floater. An inverse floater with $L < 1$ is a deleveraged floater.

LOS 43.i

Short-term funding alternatives available to banks include:

- **Customer deposits**, including checking accounts, savings accounts, and money market mutual funds.
- **Negotiable CDs**, which may be sold in the wholesale market.

- **Central bank funds market.** Banks may buy or sell excess reserves deposited with their central bank.
- **Interbank funds.** Banks make unsecured loans to one another for periods up to a year.

LOS 43.j

A repurchase agreement is a form of short-term collateralized borrowing in which one party sells a security to another party and agrees to buy it back at a predetermined future date and price. The repo rate is the implicit interest rate of a repurchase agreement. The repo margin, or haircut, is the difference between the amount borrowed and the value of the security.

Repurchase agreements are an important source of short-term financing for bond dealers. If a bond dealer is lending funds instead of borrowing, the agreement is known as a reverse repo.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 43.1

1. **B** Fixed-income sector classifications by type of issuer include government, corporate, and structured finance instruments. (LOS 43.a)
2. **C** LIBOR rates are determined in the market for interbank lending. (LOS 43.b)
3. **B** In a best-efforts offering, the investment bank or banks do not underwrite (i.e., purchase all of) a bond issue, but rather sell the bonds on a commission basis. Bonds sold by auction are offered directly to buyers by the issuer (typically a government). (LOS 43.c)
4. **A** The secondary market for bonds is primarily a dealer market in which dealers post bid and ask prices. (LOS 43.d)
5. **A** Sovereign bonds are described as *on-the-run* or *benchmark* when they represent the most recent issue in a specific maturity. (LOS 43.e)
6. **C** Bonds issued by the World Bank, which is a multilateral agency operating globally, are termed *supranational bonds*. (LOS 43.f)

Module Quiz 43.2

1. **B** With a sinking fund, the issuer must redeem part of the issue prior to maturity, but the specific bonds to be redeemed are not known. Serial bonds are issued with a schedule of maturities and each bond has a known maturity date. In an issue with a term maturity structure, all the bonds are scheduled to mature on the same date. (LOS 43.g)
2. **A** Floating-rate notes are an example of a participation instrument. (LOS 43.h)
3. **C** The interbank market refers to short-term borrowing and lending among banks of funds other than those on deposit at a central bank. Loans of reserves on deposit with a central bank are said to occur in the central bank funds market. (LOS 43.i)
4. **B** The repo rate is the percentage difference between the repurchase price and the amount borrowed. The repo margin or haircut is the percentage difference between the amount borrowed and the value of the collateral. (LOS 43.j)

1. Fixed Income Markets: Issuance, Trading, and Funding, Choudhry, M.; Mann, S.; and Whitmer, L.; in CFA Program 2020 Level I Curriculum, Volume 5 (CFA Institute, 2019).

The following is a review of the Fixed Income (1) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #44.

READING 44: INTRODUCTION TO FIXED-INCOME VALUATION

Study Session 14

EXAM FOCUS

The concepts introduced here are very important for understanding the factors that determine the value of debt securities and various yield measures. The relationships between yield to maturity, spot rates, and forward rates are core material and come up in many contexts throughout the CFA curriculum. Yield spread measures also have many applications. Note that while several of the required learning outcomes have the command word “calculate” in them, a good understanding of the underlying concepts is just as important for exam success on this material.

MODULE 44.1: BOND VALUATION AND YIELD TO MATURITY



Video covering this content is available online.

LOS 44.a: Calculate a bond's price given a market discount rate.

CFA[®] Program Curriculum: Volume 5, page 108

Calculating the Value of an Annual Coupon Bond

The value of a coupon bond can be calculated by summing the present values of all of the bond's promised cash flows. The market discount rate appropriate for discounting a bond's cash flows is called the bond's **yield-to-maturity** (YTM) or **redemption yield**. If we know a bond's yield-to-maturity, we can calculate its value, and if we know its value (market price), we can calculate its yield-to-maturity.

Consider a newly issued 10-year, \$1,000 par value, 10% coupon, annual-pay bond. The coupon payments will be \$100 at the end of each year the \$1,000 par value will be paid at the end of year 10. First, let's value this bond assuming the appropriate discount rate is 10%. The present value of the bond's cash flows discounted at 10% is:

$$\frac{100}{1.1} + \frac{100}{1.1^2} + \frac{100}{1.1^3} + \dots + \frac{100}{1.1^9} + \frac{1,100}{1.1^{10}} = 1,000$$

The calculator solution is:

$$N = 10; PMT = 100; FV = 1,000; I/Y = 10; CPT \rightarrow PV = -1,000$$

where:

N = number of years

PMT = the *annual* coupon payment

I/Y = the *annual* discount rate

FV = the par value or selling price at the end of an assumed holding period



PROFESSOR'S NOTE

Take note of a couple of points here. The discount rate is entered as a whole number in percent, 10, not 0.10. The 10 coupon payments of \$100 each are taken care of in the $N = 10$ and $PMT = 100$ entries. The principal repayment is in the $FV = 1,000$ entry. Lastly, note that the PV is negative; it will be the opposite sign to the sign of PMT and FV. The calculator is just “thinking” that to receive the payments and future value (to own the bond), you must pay the present value of the bond today (you must buy the bond). That’s why the PV amount is negative; it is a cash outflow to a bond buyer.

Now let’s value that same bond with a discount rate of 8%:

$$\frac{100}{1.08} + \frac{100}{1.08^2} + \frac{100}{1.08^3} + \dots + \frac{100}{1.08^9} + \frac{1,100}{1.08^{10}} = 1,134.20$$

The calculator solution is:

$$N = 10; PMT = 100; FV = 1,000; I/Y = 8; CPT \rightarrow PV = -1,134.20$$

If the market discount rate for this bond were 8%, it would sell at a premium of \$134.20 above its par value. **When bond yields decrease, the present value of a bond’s payments, its market value, increases.**

If we discount the bond’s cash flows at 12%, the present value of the bond is:

$$\frac{100}{1.12} + \frac{100}{1.12^2} + \frac{100}{1.12^3} + \dots + \frac{100}{1.12^9} + \frac{1,100}{1.12^{10}} = 887.00$$

The calculator solution is:

$$N = 10; PMT = 100; FV = 1,000; I/Y = 12; CPT \rightarrow PV = -887$$

If the market discount rate for this bond were 12%, it would sell at a discount of \$113 to its par value. **When bond yields increase, the present value of a bond’s payments, its market value, decreases.**



PROFESSOR'S NOTE

It’s worth noting here that a 2% decrease in yield-to-maturity increases the bond’s value by more than a 2% increase in yield decreases the bond’s value. This illustrates that the bond’s price-yield relationship is convex, as we will explain in more detail in a later topic review.

Calculating the value of a bond with semiannual coupon payments. Let’s calculate the value of the same bond with semiannual payments.

Rather than \$100 per year, the security will pay \$50 every six months. With an annual YTM of 8%, we need to discount the coupon payments at 4% per period which results in a present value of:

$$\frac{50}{1.04} + \frac{50}{1.04^2} + \frac{50}{1.04^3} + \dots + \frac{50}{1.04^{19}} + \frac{1,050}{1.04^{20}} = 1,135.90$$

The calculator solution is:

$$N = 20; PMT = 50; FV = 1,000; I/Y = 4; CPT \rightarrow PV = -1,135.90$$

The value of a zero-coupon bond is simply the present value of the maturity payment. With a discount rate of 3% per period, a 5-period zero-coupon bond with a par value of \$1,000 has a value of:

$$\frac{1,000}{1.03^5} = \$862.61$$

LOS 44.b: Identify the relationships among a bond's price, coupon rate, maturity, and market discount rate (yield-to-maturity).

CFA® Program Curriculum: Volume 5, page 113

So far we have used a bond's cash flows and an assumed discount rate to calculate the value of the bond. We can also calculate the market discount rate given a bond's price in the market, because there is an inverse relationship between price and yield. For a 3-year, 8% annual coupon bond that is priced at 90.393, the market discount rate is:

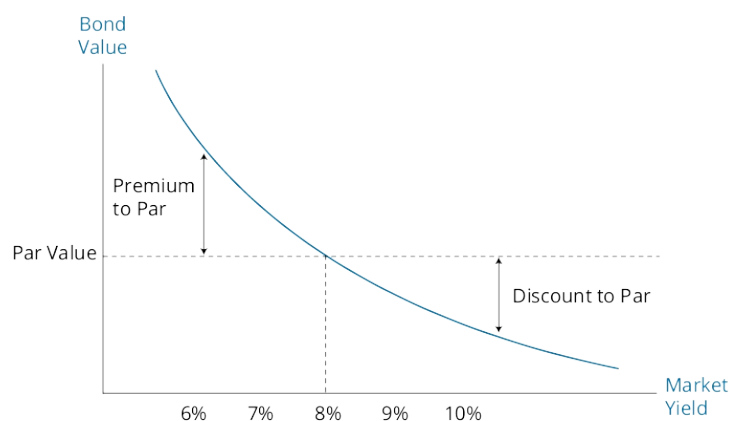
$$N = 3; PMT = 8; FV = 100; PV = -90.393; CPT \rightarrow I/Y = 12\%$$

We can summarize the relationships between price and yield as follows:

1. At a point in time, a decrease (increase) in a bond's YTM will increase (decrease) its price.
2. If a bond's coupon rate is greater than its YTM, its price will be at a premium to par value. If a bond's coupon rate is less than its YTM, its price will be at a discount to par value.
3. The percentage decrease in value when the YTM increases by a given amount is smaller than the increase in value when the YTM decreases by the same amount (the price-yield relationship is convex).
4. Other things equal, the price of a bond with a lower coupon rate is more sensitive to a change in yield than is the price of a bond with a higher coupon rate.
5. Other things equal, the price of a bond with a longer maturity is more sensitive to a change in yield than is the price of a bond with a shorter maturity.

[Figure 44.1](#) illustrates the convex relationship between a bond's price and its yield-to-maturity:

Figure 44.1: Market Yield vs. Bond Value for an 8% Coupon Bond



Relationship Between Price and Maturity

Prior to maturity, a bond can be selling at a significant discount or premium to par value. However, regardless of its required yield, the price will converge to par value as maturity approaches. Consider a bond with \$1,000 par value and a 3-year life paying 6% semiannual

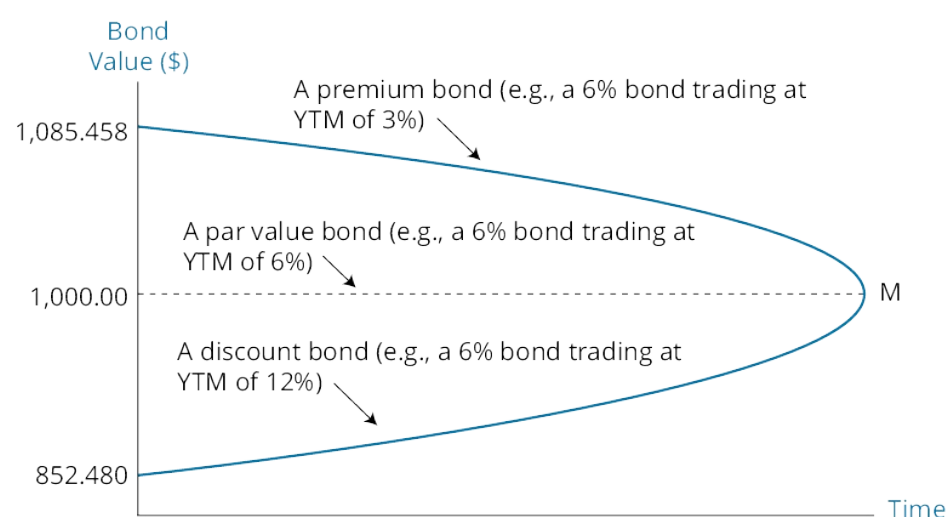
coupons. The bond values corresponding to required yields of 3%, 6%, and 12% as the bond approaches maturity are presented in [Figure 44.2](#).

Figure 44.2: Bond Values and the Passage of Time

Time to Maturity (in years)	YTM = 3%	YTM = 6%	YTM = 12%
3.0	\$1,085.46	\$1,000.00	\$852.48
2.5	1,071.74	1,000.00	873.63
2.0	1,057.82	1,000.00	896.05
1.5	1,043.68	1,000.00	919.81
1.0	1,029.34	1,000.00	945.00
0.5	1,014.78	1,000.00	971.69
0.0	1,000.00	1,000.00	1,000.00

The change in value associated with the passage of time for the three bonds represented in [Figure 44.2](#) is presented graphically in [Figure 44.3](#). This convergence to par value at maturity is known as the **constant-yield price trajectory** because it shows how the bond's price would change as time passes if its yield-to-maturity remained constant.

Figure 44.3: Premium, Par, and Discount Bonds



MODULE QUIZ 44.1

To best evaluate your performance, enter your quiz answers online.

1. A 20-year, 10% annual-pay bond has a par value of \$1,000. What is the price of the bond if it has a yield-to-maturity of 15%?

- A. \$685.14.
 - B. \$687.03.
 - C. \$828.39.
2. An analyst observes a 5-year, 10% semiannual-pay bond. The face amount is £1,000. The analyst believes that the yield-to-maturity on a semiannual bond basis should be 15%. Based on this yield estimate, the price of this bond would be:
- A. £828.40.
 - B. £1,189.53.
 - C. £1,193.04.
3. An analyst observes a 20-year, 8% option-free bond with semiannual coupons. The required yield-to-maturity on a semiannual bond basis was 8%, but suddenly it decreased to 7.25%. As a result, the price of this bond:
- A. increased.
 - B. decreased.
 - C. stayed the same.
4. A \$1,000, 5%, 20-year annual-pay bond has a YTM of 6.5%. If the YTM remains unchanged, how much will the bond value increase over the next three years?
- A. \$13.62.
 - B. \$13.78.
 - C. \$13.96.

MODULE 44.2: SPOT RATES AND ACCRUED INTEREST



Video covering this content is available online.

LOS 44.c: Define spot rates and calculate the price of a bond using spot rates.

CFA® Program Curriculum: Volume 5, page 117

The yield-to-maturity is calculated as if the discount rate for every bond cash flow is the same. In reality, discount rates depend on the time period in which the bond payment will be made. **Spot rates** are the market discount rates for a single payment to be received in the future. The discount rates for zero-coupon bonds are spot rates and we sometimes refer to spot rates as *zero-coupon rates* or simply *zero rates*.

In order to price a bond with spot rates, we sum the present values of the bond's payments, each discounted at the spot rate for the number of periods before it will be paid. The general equation for calculating a bond's value using spot rates (S_i) is:

$$\frac{CPN_1}{1+S_1} + \frac{CPN_2}{(1+S_2)^2} + \dots + \frac{CPN_N+FV_N}{(1+S_N)^N} = PV$$

EXAMPLE: Valuing a bond using spot rates

Given the following spot rates, calculate the value of a 3-year, 5% annual-coupon bond.

Spot rates

1-year: 3%

2-year: 4%

3-year: 5%

Answer:

$$\frac{50}{1.03} + \frac{50}{(1.04)^2} + \frac{1,050}{(1.05)^3} = 48.54 + 46.23 + 907.03 = \$1,001.80$$

This price, calculated using spot rates, is sometimes called the *no-arbitrage price* of a bond because if a bond is priced differently there will be a profit opportunity from arbitrage among bonds.

Because the bond value is slightly greater than its par value, we know its YTM is slightly less than its coupon rate of 5%. Using the price of 1,001.80, we can calculate the YTM for this bond as:

$$N = 3; PMT = 50; FV = 1,000; PV = -1,001.80; CPT \rightarrow I/Y = 4.93\%$$

LOS 44.d: Describe and calculate the flat price, accrued interest, and the full price of a bond.

CFA® Program Curriculum: Volume 5, page 119

The coupon bond values we have calculated so far are calculated on the date a coupon is paid, as the present value of the remaining coupons. For most bond trades, the settlement date, which is when cash is exchanged for the bond, will fall between coupon payment dates. As time passes (and future coupon payment dates get closer), the value of the bond will increase.

The value of a bond between coupon dates can be calculated, using its current YTM, as the value of the bond on its last coupon date (PV) times $(1 + YTM / \# \text{ of coupon periods per year})^{t/T}$, where t is the number of days since the last coupon payment, and T is the number of days in the coupon period. For a given settlement date, this value is referred to as the **full price** of the bond.

Let's work an example for a specific bond:

EXAMPLE: Calculating the full price of a bond

A 5% bond makes coupon payments on June 15 and December 15 and is trading with a YTM of 4%. The bond is purchased and will settle on August 21 when there will be four coupons remaining until maturity. Calculate the full price of the bond using actual days.

Step 1: Calculate the value of the bond on the last coupon date (coupons are semiannual, so we use $4 / 2 = 2\%$ for the periodic discount rate):

$$N = 4; PMT = 25; FV = 1,000; I/Y = 2; CPT \rightarrow PV = -1,019.04$$

Step 2: Adjust for the number of days since the last coupon payment:

Days between June 15 and December 15 = 183 days.

Days between June 15 and settlement on August 21 = 67 days.

$$\text{Full price} = 1,019.04 \times (1.02)^{67/183} = 1,026.46.$$

The accrued interest since the last payment date can be calculated as the coupon payment times the portion of the coupon period that has passed between the last coupon payment date and the settlement date of the transaction. For the bond in the previous example, the accrued interest on the settlement date of August 21 is:

$$\$25 (67 / 183) = \$9.15$$

The full price (invoice price) minus the accrued interest is referred to as the **flat price** of the bond.

$$\text{flat price} = \text{full price} - \text{accrued interest}$$

So for the bond in our example, the flat price = $1,026.46 - 9.15 = 1,017.31$.

The flat price of the bond is also referred to as the bond's **clean price** or **quoted price**, and the full price is also referred to as the **dirty price**.

Note that the flat price is not the present value of the bond on its last coupon payment date, $1,017.31 < 1,019.04$.

So far, in calculating accrued interest, we used the actual number of days between coupon payments and the actual number of days between the last coupon date and the settlement date. This actual/actual method is used most often with government bonds. The 30/360 method is most often used for corporate bonds. This method assumes that there are 30 days in each month and 360 days in a year.

EXAMPLE: Accrued interest

An investor buys a \$1,000 par value, 4% annual-pay bond that pays its coupons on May 15. The investor's buy order settles on August 10. Calculate the accrued interest that is owed to the bond seller, using the 30/360 method and the actual/actual method.

Answer:

The annual coupon payment is $4\% \times \$1,000 = \40 .

Using the 30/360 method, interest is accrued for $30 - 15 = 15$ days in May; 30 days each in June and July; and 10 days in August, or $15 + 30 + 30 + 10 = 85$ days.

$$\text{accrued interest (30/360 method)} = \frac{85}{360} \times \$40 = \$9.44$$

Using the actual/actual method, interest is accrued for $31 - 15 = 16$ days in May; 30 days in June; 31 days in July; and 10 days in August, or $16 + 30 + 31 + 10 = 87$ days.

$$\text{accrued interest (actual/actual method)} = \frac{87}{365} \times \$40 = \$9.53$$

LOS 44.e: Describe matrix pricing.

CFA® Program Curriculum: Volume 5, page 123

Matrix pricing is a method of estimating the required yield-to-maturity (or price) of bonds that are currently not traded or infrequently traded. The procedure is to use the YTM of traded bonds that have credit quality very close to that of a nontraded or infrequently traded bond and are similar in maturity and coupon, to estimate the required YTM.

EXAMPLE: Pricing an illiquid bond

Rob Phelps, CFA, is estimating the value of a nontraded 4% annual-pay, A+ rated bond that has three years remaining until maturity. He has obtained the following yields-to-maturity on similar corporate bonds:

- A+ rated, 2-year annual-pay, YTM = 4.3%
- A+ rated, 5-year annual-pay, YTM = 5.1%
- A+ rated, 5-year annual-pay, YTM = 5.3%

Estimate the value of the nontraded bond.

Answer:

- Step 1:** Take the average YTM of the 5-year bonds: $(5.1 + 5.3) / 2 = 5.2\%$.
- Step 2:** Interpolate the 3-year YTM based on the 2-year and average 5-year YTM:
 $4.3\% + (5.2\% - 4.3\%) \times [(3 \text{ years} - 2 \text{ years}) / (5 \text{ years} - 2 \text{ years})] = 4.6\%$
- Step 3:** Price the nontraded bond with a YTM of 4.6%:
 $N = 3; PMT = 40; FV = 1,000; I/Y = 4.6; CPT \rightarrow PV = -983.54$
 The estimated value is \$983.54 per \$1,000 par value.

In using the averages in the preceding example, we have used simple *linear interpolation*. Because the maturity of the nontraded bond is three years, we estimate the YTM on the 3-year bond as the yield on the 2-year bond, plus one-third of the difference between the YTM of the 2-year bond and the average YTM of the 5-year bonds. Note that the difference in maturity between the 2-year bond and the 3-year bond is one year and the difference between the maturities of the 2-year and 5-year bonds is three years.

A variation of matrix pricing used for pricing new bond issues focuses on the spreads between bond yields and the yields of a benchmark bond of similar maturity that is essentially default risk free. Often the yields on Treasury bonds are used as benchmark yields for U.S. dollar-denominated corporate bonds. When estimating the YTM for the new issue bond, the appropriate spread to the yield of a Treasury bond of the same maturity is estimated and added to the yield of the benchmark issue.

EXAMPLE: Estimating the spread for a new 6-year, A rated bond issue

Consider the following market yields:

- 5-year, U.S. Treasury bond, YTM 1.48%
- 5-year, A rated corporate bond, YTM 2.64%
- 7-year, U.S. Treasury bond, YTM 2.15%
- 7-year, A rated corporate bond, YTM 3.55%
- 6-year U.S. Treasury bond, YTM 1.74%

Estimate the required yield on a newly issued 6-year, A rated corporate bond.

Answer:

1. Calculate the spreads to the benchmark (Treasury) yields.
 Spread on the 5-year corporate bond is $2.64 - 1.48 = 1.16\%$.
 Spread on the 7-year corporate bond is $3.55 - 2.15 = 1.40\%$.
2. Calculate the average spread because the 6-year bond is the midpoint of five and seven years.
 Average spread = $(1.16 + 1.40) / 2 = 1.28\%$.
3. Add the average spread to the YTM of the 6-year Treasury (benchmark) bond.
 $1.74 + 1.28 = 3.02\%$, which is our estimate of the YTM on the newly issued 6-year, A rated bond.

**MODULE QUIZ 44.2**

To best evaluate your performance, enter your quiz answers online.

1. If spot rates are 3.2% for one year, 3.4% for two years, and 3.5% for three years, the price of a \$100,000 face value, 3-year, annual-pay bond with a coupon rate of 4% is *closest* to:
 - A. \$101,420.
 - B. \$101,790.

- C. \$108,230.
2. An investor paid a full price of \$1,059.04 each for 100 bonds. The purchase was between coupon dates, and accrued interest was \$23.54 per bond. What is each bond's flat price?
- \$1,000.00.
 - \$1,035.50.
 - \$1,082.58.
3. Cathy Moran, CFA, is estimating a value for an infrequently traded bond with six years to maturity, an annual coupon of 7%, and a single-B credit rating. Moran obtains yields-to-maturity for more liquid bonds with the same credit rating:
- 5% coupon, eight years to maturity, yielding 7.20%.
 - 6.5% coupon, five years to maturity, yielding 6.40%.
- The infrequently traded bond is *most likely* trading at:
- par value.
 - a discount to par value.
 - a premium to par value.

MODULE 44.3: YIELD MEASURES



Video covering this content is available online.

LOS 44.f: Calculate annual yield on a bond for varying compounding periods in a year.

LOS 44.g: Calculate and interpret yield measures for fixed-rate bonds and floating-rate notes.

CFA® Program Curriculum: Volume 5, page 126

Given a bond's price in the market, we can say that the YTM is the discount rate that makes the present value of a bond's cash flows equal to its price. For a 5-year, annual pay 7% bond that is priced in the market at \$1,020.78, the YTM will satisfy the following equation:

$$\frac{70}{1+YTM} + \frac{70}{(1+YTM)^2} + \frac{70}{(1+YTM)^3} + \frac{70}{(1+YTM)^4} + \frac{1,070}{(1+YTM)^5} = 1,020.78$$

We can calculate the YTM (discount rate) that satisfies this equality as:

$$N = 5; PMT = 70; FV = 1,000; PV = -1,020.78; CPT \rightarrow I/Y = 6.5\%$$

By convention, the YTM on a semiannual coupon bond is expressed as two times the semiannual discount rate. For a 5-year, semiannual pay 7% coupon bond, we can calculate the semiannual discount rate as YTM/2 and then double it to get the YTM expressed as an annual yield:

$$\frac{35}{1+YTM/2} + \frac{35}{(1+YTM/2)^2} + \frac{35}{(1+YTM/2)^3} + \dots + \frac{35}{(1+YTM/2)^9} + \frac{1,035}{(1+YTM/2)^{10}} = 1,020.78$$

$$N = 10; PMT = 35; FV = 1,000; PV = -1,020.78; CPT \rightarrow I/Y = 3.253\%$$

The YTM is $3.253 \times 2 = 6.506\%$.

Yield Measures for Fixed-Rate Bonds

The number of bond coupon payments per year is referred to as the **periodicity** of a bond. A bond with a periodicity of 2 will have its yield to maturity quoted on a **semiannual bond basis**. For a given coupon rate, the greater the periodicity, the more compounding periods, and the greater the annual yield.



PROFESSOR'S NOTE

This is analogous to the relationship among a stated annual rate, the number of compounding periods per year, and the effective annual yield explained in Quantitative Methods.

In general, the annual (effective) yield for bond with its YTM stated for a periodicity of n , and n compounding periods per year, is:

$$\text{annual yield} = \left(1 + \frac{\text{YTM}}{n}\right)^n - 1$$

EXAMPLE: Effective annual yields

What is the annual yield for a bond with a stated YTM of 10%:

1. When the periodicity of the bond is 2 (pays semiannually)?
2. When the periodicity of the bond is 4 (pays quarterly)?

Answer:

1. $\text{annual yield} = \left(1 + \frac{0.10}{2}\right)^2 - 1 = 1.05^2 - 1 = 0.1025 = 10.25\%$

2. $\text{annual yield} = \left(1 + \frac{0.10}{4}\right)^4 - 1 = 1.025^4 - 1 = 0.1038 = 10.38\%$

It may be necessary to adjust the quoted yield on a bond to make it comparable with the yield on a bond with a different periodicity. This is illustrated in the following example.

EXAMPLE: Adjusting yields for periodicity

An Atlas Corporation bond is quoted with a YTM of 4% on a semiannual bond basis. What yields should be used to compare it with a quarterly-pay bond and an annual-pay bond?

Answer:

The first thing to note is that 4% on a semiannual bond basis is an effective yield of 2% per 6-month period.

To compare this with the yield on an annual-pay bond, which is an effective annual yield, we need to calculate the effective annual yield on the semiannual coupon bond, which is $1.02^2 - 1 = 4.04\%$.

For the annual YTM on the quarterly-pay bond, we need to calculate the effective quarterly yield and multiply by four. The quarterly yield (yield per quarter) that is equivalent to a yield of 2% per six months is $1.02^{1/2} - 1 = 0.995\%$. The quoted annual rate for the equivalent yield on a quarterly bond basis is $4 \times 0.995 = 3.98\%$.

Note that we have shown that the effective annual yields are the same for:

- An annual coupon bond with a yield of 4.04% on an annual basis (periodicity of one).
- A semiannual coupon bond with a yield of 4.0% on a semiannual basis (periodicity of two).
- A quarterly coupon bond with a yield of 3.98% on quarterly basis (periodicity of four).

Bond yields calculated using the stated coupon payment dates are referred to as following the **street convention**. Because some coupon dates will fall on weekends and holidays, coupon payments will actually be made the next business day. The yield calculated using these actual coupon payment dates is referred to as the **true yield**. Some coupon payments will be made later when holidays and weekends are taken into account, so true yields will be slightly lower than street convention yields, if only by a few basis points.

When calculating spreads between government bond yields and the yield on a corporate bond, the corporate bond yield is often restated to its yield on actual/actual basis to match the day count convention used on government bonds (rather than the 30/360 day count convention used for calculating corporate bond yields).

Current yield (also called **income yield** or **running yield**) is simple to calculate, but offers limited information. This measure looks at just one source of return: *a bond's annual interest income*—it does not consider capital gains/losses or reinvestment income. The formula for the current yield is:

$$\text{current yield} = \frac{\text{annual cash coupon payment}}{\text{bond price}}$$

EXAMPLE: Computing current yield

Consider a 20-year, \$1,000 par value, 6% *semiannual-pay* bond that is currently trading at a flat price of \$802.07. Calculate the current yield.

Answer:

The *annual* cash coupon payments total:

$$\text{annual cash coupon payment} = \text{par value} \times \text{stated coupon rate} = \$1,000 \times 0.06 = \$60$$

Because the bond is trading at \$802.07, the current yield is:

$$\text{current yield} = \frac{60}{802.07} = 0.0748, \text{ or } 7.48\%.$$

Note that current yield is based on *annual* coupon interest so that it is the same for a semiannual-pay and annual-pay bond with the same coupon rate and price.

The current yield does not account for gains or losses as the bond's price moves toward its par value over time. A bond's **simple yield** takes a discount or premium into account by assuming that any discount or premium declines evenly over the remaining years to maturity. The sum of the annual coupon payment plus (minus) the straight-line amortization of a discount (premium) is divided by the flat price to get the simple yield.

EXAMPLE: Computing simple yield

A 3-year, 8% coupon, semiannual-pay bond is priced at 90.165. Calculate the simple yield.

Answer:

The discount from par value is $100 - 90.165 = 9.835$. Annual straight-line amortization of the discount is $9.835 / 3 = 3.278$.

$$\text{simple yield} = \frac{8 + 3.278}{90.165} = 12.51\%$$

For a callable bond, an investor's yield will depend on whether and when the bond is called. The **yield-to-call** can be calculated for each possible call date and price. The lowest of yield-to-maturity and the various yields-to-call is termed the **yield-to-worst**. The following example illustrates these calculations.

EXAMPLE: Yield-to-call and yield-to-worst

Consider a 10-year, semiannual-pay 6% bond trading at 102 on January 1, 2014. The bond is callable according to the following schedule:

Callable at 102 on or after January 1, 2019.

Callable at 100 on or after January 1, 2022.

Calculate the bond's YTM, yield-to-first call, yield-to-first par call, and yield-to-worst.

Answer:

The *yield-to-maturity* on the bond is calculated as:

$$N = 20; PMT = 30; FV = 1,000; PV = -1,020; CPT \rightarrow I/Y = 2.867\%$$

$$2 \times 2.867 = 5.734\% = YTM$$

To calculate the *yield-to-first call*, we calculate the yield-to-maturity using the number of semiannual periods until the first call date (10) for N and the call price (1,020) for FV :

$$N = 10; PMT = 30; FV = 1,020; PV = -1,020; CPT \rightarrow I/Y = 2.941\%$$

$$2 \times 2.941 = 5.882\% = \text{yield-to-first call}$$

To calculate the *yield-to-first par call* (second call date), we calculate the yield-to-maturity using the number of semiannual periods until the first par call date (16) for N and the call price (1,000) for FV :

$$N = 16; PMT = 30; FV = 1,000; PV = -1,020; CPT \rightarrow I/Y = 2.843\%$$

$$2 \times 2.843 = 5.686\% = \text{yield-to-first par call}$$

The lowest yield, 5.686%, is realized if the bond is called at par on January 1, 2022, so the *yield-to-worst* is 5.686%.

The **option-adjusted yield** is calculated by adding the value of the call option to the bond's current flat price. The value of a callable bond is equal to the value of the bond if it did not have the call option, minus the value of the call option (because the issuer *owns* the call option).

The option-adjusted yield will be less than the yield-to-maturity for a callable bond because callable bonds have higher yields to compensate bondholders for the issuer's call option. The option-adjusted yield can be used to compare the yields of bonds with various embedded options to each other and to similar option-free bonds.

Floating-Rate Note Yields

The values of floating rate notes (FRNs) are more stable than those of fixed-rate debt of similar maturity because the coupon interest rates are reset periodically based on a reference rate. Recall that the coupon rate on a floating-rate note is the reference rate plus or minus a margin based on the credit risk of the bond relative to the credit risk of the reference rate instrument. The coupon rate for the next period is set using the current reference rate for the reset period, and the payment at the end of the period is based on this rate. For this reason, we say that interest is paid *in arrears*.

If an FRN is issued by a company that has more (less) credit risk than the banks quoting LIBOR, a margin is added to (subtracted from) LIBOR, the reference rate. The liquidity of an FRN and its tax treatment can also affect the margin.

We call the margin used to calculate the bond coupon payments the **quoted margin** and we call the margin required to return the FRN to its par value the **required margin** (also called

the **discount margin**). When the credit quality of an FRN is unchanged, the quoted margin is equal to the required margin and the FRN returns to its par value at each reset date when the next coupon payment is reset to the current market rate (plus or minus the appropriate margin).

If the credit quality of the issuer decreases, the quoted margin will be less than the required margin and the FRN will sell at a discount to its par value. If credit quality has improved, the quoted margin will be greater than the required margin and the FRN will sell at a premium to its par value.

A somewhat simplified way of calculating the value of an FRN on a reset date is to use the current reference rate plus the quoted margin to estimate the future cash flows for the FRN and to discount these future cash flows at the reference rate plus the required (discount) margin. More complex models produce better estimates of value.

EXAMPLE: Valuation of a floating-rate note

A \$100,000 floating rate note is based on 180-day LIBOR (the reference rate) with a quoted margin of 120 basis points. On a reset date with 5 years remaining to maturity, 180-day LIBOR is quoted as 3.0% (annualized) and the discount margin (based on the issuer's current credit rating) is 4.5% (annualized). What is the market value of the floating rate note?

Answer:

The current annualized coupon rate on the note is $3.0\% + 1.2\% = 4.2\%$, so the next semiannual coupon payment will be $4.2\% / 2 = 2.1\%$ of face value. The required return in the market (discount margin) as an effective 180-day discount rate is $4.5\% / 2 = 2.25\%$.

Using a face value of 100%, 10 coupon payments of 2.1%, and a discount rate per period of 2.25%, we can calculate the present value of the floating rate note as:

$N = 10$; $I/Y = 2.25\%$; $FV = 100$; $PMT = 2.1$; $CPT PV = 98.67$

The current value of the note is 98.67% of its face value, or \$98,670.

LOS 44.h: Calculate and interpret yield measures for money market instruments.

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Recall that yields on money market securities can be stated as a discount from face value or as add-on yields, and can be based on a 360-day or 365-day basis. U.S. Treasury bills are quoted as annualized discounts from face value based on a 360-day year. LIBOR and bank CD rates are quoted as add-on yields. We need to be able to:

- Calculate the actual payment on a money market security given its yield and knowledge of how the yield was calculated.
- Compare the yields on two securities that are quoted on different yield bases.

Both discount basis and add-on yields in the money market are quoted as simple annual interest. The following example illustrates the required calculations and quote conventions.

EXAMPLE: Money market yields

1. A \$1,000 90-day T-bill is priced with an annualized discount of 1.2%. Calculate its market price and its annualized add-on yield based on a 365-day year.
2. A \$1 million negotiable CD with 120 days to maturity is quoted with an add-on yield of 1.4% based on a 365-day year. Calculate the payment at maturity for this CD and its bond equivalent yield.

3. A bank deposit for 100 days is quoted with an add-on yield of 1.5% based on a 360-day year. Calculate the bond equivalent yield and the yield on a semiannual bond basis.

Answer:

1. The discount from face value is $1.2\% \times 90 / 360 \times 1,000 = \3 so the current price is $1,000 - 3 = \$997$.

The equivalent add-on yield for 90 days is $3 / 997 = 0.3009\%$. The annualized add-on yield based on a 365-day year is $365 / 90 \times 0.3009 = 1.2203\%$. This add-on yield based on a 365-day year is referred to as the **bond equivalent yield** for a money market security.

2. The add-on interest for the 120-day period is $120 / 365 \times 1.4\% = 0.4603\%$.

At maturity, the CD will pay $\$1 \text{ million} \times (1 + 0.004603) = \$1,004,603$.

The quoted yield on the CD is the bond equivalent yield because it is an add-on yield annualized based on a 365-day year.

3. Because the yield of 1.5% is an annualized effective yield calculated based on a 360-day year, the bond equivalent yield, which is based on a 365-day year, is:

$$(365 / 360) \times 1.5\% = 1.5208\%$$

We may want to compare the yield on a money market security to the YTM of a semiannual-pay bond. The method is to convert the money market security's holding period return to an effective semiannual yield, and then double it.

Because the yield of 1.5% is calculated as the add-on yield for 100 days times $100 / 360$, the 100-day holding period return is $1.5\% \times 100 / 360 = 0.4167\%$. The effective annual yield is $1.004167^{365/100} - 1 = 1.5294\%$, the equivalent semiannual yield is $1.015294^{1/2} - 1 = 0.7618\%$, and the annual yield on a semiannual bond basis is $2 \times 0.7618\% = 1.5236\%$.

Because the periodicity of the money market security, $365 / 100$, is greater than the periodicity of 2 for a semiannual-pay bond, the simple annual rate for the money market security, 1.5%, is less than the yield on a semiannual bond basis, which has a periodicity of 2.



MODULE QUIZ 44.3

To best evaluate your performance, enter your quiz answers online.

1. A market rate of discount for a single payment to be made in the future is:
 - A. a spot rate.
 - B. a simple yield.
 - C. a forward rate.
2. Based on semiannual compounding, what would the YTM be on a 15-year, zero-coupon, \$1,000 par value bond that's currently trading at \$331.40?
 - A. 3.750%.
 - B. 5.151%.
 - C. 7.500%.
3. An analyst observes a Widget & Co. 7.125%, 4-year, semiannual-pay bond trading at 102.347% of par (where par is \$1,000). The bond is callable at 101 in two years. What is the bond's yield-to-call?
 - A. 3.167%.
 - B. 5.664%.
 - C. 6.334%.
4. A floating-rate note has a quoted margin of +50 basis points and a required margin of +75 basis points. On its next reset date, the price of the note will be:
 - A. equal to par value.
 - B. less than par value.
 - C. greater than par value.
5. Which of the following money market yields is a bond-equivalent yield?
 - A. Add-on yield based on a 365-day year.
 - B. Discount yield based on a 360-day year.
 - C. Discount yield based on a 365-day year.

MODULE 44.4: YIELD CURVES



LOS 44.i: Define and compare the spot curve, yield curve on coupon bonds, par curve, and forward curve.

Video covering this content is available online.

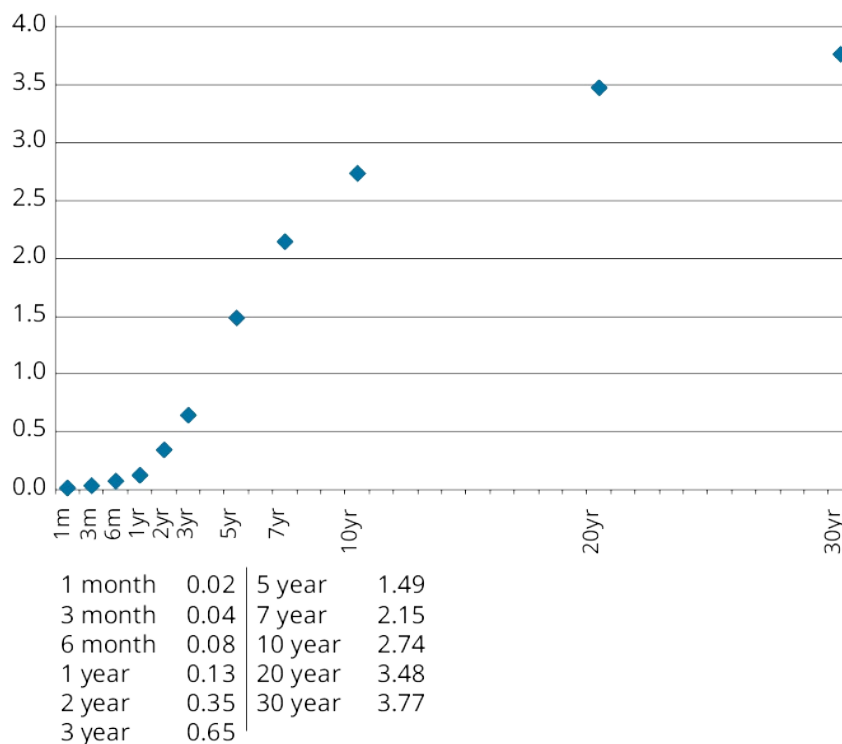
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A **yield curve** shows yields by maturity. Yield curves are constructed for yields of various types and it's very important to understand exactly which yield is being shown. The **term structure** of interest rates refers to the yields at different maturities (terms) for like securities or interest rates. The yields on U.S. Treasury coupon bonds by maturity can be found at Treasury.gov, and several yield curves are available at Bloomberg.com.

The **spot rate yield curve** (spot curve) for U.S. Treasury bonds is also referred to as the *zero curve* (for zero-coupon) or *strip curve* (because zero-coupon U.S. Treasury bonds are also called *stripped Treasuries*). Recall that spot rates are the appropriate yields, and therefore appropriate discount rates, for single payments to be made in the future. Yields on zero-coupon government bonds are spot rates. Earlier in this topic review, we calculated the value of a bond by discounting each separate payment by the spot rate corresponding to the time until the payment will be received. Spot rates are usually quoted on a semiannual bond basis, so they are directly comparable to YTMs quoted for coupon government bonds.

A **yield curve for coupon bonds** shows the YTMs for coupon bonds at various maturities. Yields are calculated for several maturities and yields for bonds with maturities between these are estimated by linear interpolation. [Figure 44.4](#) shows a yield curve for coupon Treasury bonds constructed from yields on 1-month, 3-month, 6-month, 1-year, 2-year, 3-year, 5-year, 7-year, 10-year, 20 year, and 30-year maturities. Yields are expressed on a semiannual bond basis.

Figure 44.4: U.S. Treasury Yield Curve as of August 1, 2013



Source: www.treasury.gov/resource-center

A **par bond yield curve**, or *par curve*, is not calculated from yields on actual bonds but is constructed from the spot curve. The yields reflect the coupon rate that a hypothetical bond at each maturity would need to have to be priced at par. Alternatively, they can be viewed as the YTM of a par bond at each maturity.

Consider a 3-year annual-pay bond and spot rates for one, two, and three years of S_1 , S_2 , and S_3 . The following equation can be used to calculate the coupon rate necessary for the bond to be trading at par.

$$\frac{PMT}{1+S_1} + \frac{PMT}{(1+S_2)^2} + \frac{PMT+100}{(1+S_3)^3} = 100$$

With spot rates of 1%, 2%, and 3%, a 3-year annual par bond will have a payment that will satisfy:

$$\frac{PMT}{1.01} + \frac{PMT}{(1.02)^2} + \frac{PMT+100}{(1.03)^3} = 100, \text{ so the payment is 2.96 and the par bond}$$

coupon rate is 2.96%.

Forward rates are yields for future periods. The rate of interest on a 1-year loan that would be made two years from now is a forward rate. A **forward yield curve** shows the future rates for bonds or money market securities for the same maturities for annual periods in the future. Typically, the forward curve would show the yields of 1-year securities for each future year, quoted on a semiannual bond basis.

LOS 44.j: Define forward rates and calculate spot rates from forward rates, forward rates from spot rates, and the price of a bond using forward rates.

A forward rate is a borrowing/lending rate for a loan to be made at some future date. The notation used must identify both the length of the lending/borrowing period and when in the future the money will be loaned/borrowed. Thus, 1y1y is the rate for a 1-year loan one year from now; 2y1y is the rate for a 1-year loan to be made two years from now; 3y2y is the 2-year forward rate three years from now; and so on.

The Relationship Between Short-Term Forward Rates and Spot Rates

The idea here is that *borrowing for three years at the 3-year spot rate, or borrowing for one-year periods in three successive years, should have the same cost.* The S_i are the current spot rates for i periods.

This relation is illustrated as $(1 + S_3)^3 = (1 + S_1)(1 + 1y1y)(1 + 2y1y)$. Thus, $S_3 = [(1 + S_1)(1 + 1y1y)(1 + 2y1y)]^{1/3} - 1$, which is the geometric mean return we covered in Quantitative Methods.

EXAMPLE: Computing spot rates from forward rates

If the current 1-year spot rate is 2%, the 1-year forward rate one year from today (1y1y) is 3%, and the 1-year forward rate two years from today (2y1y) is 4%, what is the 3-year spot rate?

Answer:

$$S_3 = [(1.02)(1.03)(1.04)]^{1/3} - 1 = 2.997\%$$

This can be interpreted to mean that a dollar compounded at 2.997% for three years would produce the same ending value as a dollar that earns compound interest of 2% the first year, 3% the next year, and 4% for the third year.



PROFESSOR'S NOTE

You can get a very good approximation of the 3-year spot rate with the simple average of the forward rates. In the previous example, we calculated 2.997% and the simple average of the three annual rates is:

$$\frac{2+3+4}{3} = 3\%.$$

Forward Rates Given Spot Rates

We can use the same relationships we use to calculate spot rates from forward rates to calculate forward rates from spot rates.

Our basic relation between forward rates and spot rates (for two periods) is:

$$(1 + S_2)^2 = (1 + S_1)(1 + 1y1y)$$

This again tells us that an investment has the same expected yield (borrowing has the same expected cost) whether we invest (borrow) for two periods at the 2-period spot rate, S_2 , or for one period at the current 1-year rate, S_1 , and for the next period at the forward rate, 1y1y. Given two of these rates, we can solve for the other.

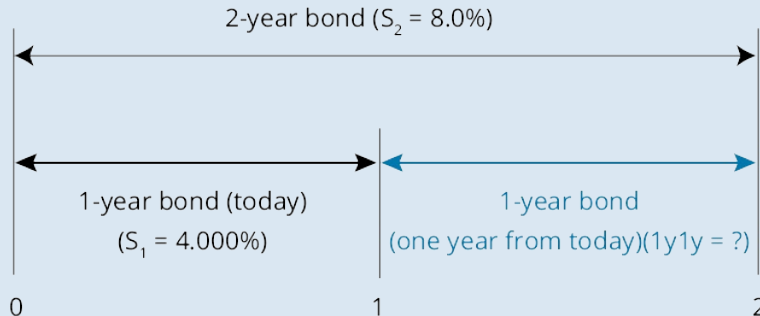
EXAMPLE: Computing a forward rate from spot rates

The 2-period spot rate, S_2 , is 8%, and the 1-period spot rate, S_1 , is 4%. Calculate the forward rate for one period, one period from now, $1y1y$.

Answer:

The following figure illustrates the problem.

Finding a Forward Rate



From our original equality, $(1 + S_2)^2 = (1 + S_1)(1 + 1y1y)$, we can get

$$\frac{(1+S_2)^2}{(1+S_1)} = (1 + 1y1y)$$

Or, because we know that both choices have the same payoff in two years:

$$(1.08)^2 = (1.04)(1 + 1y1y)$$

$$(1 + 1y1y) = \frac{(1.08)^2}{(1.04)}$$

$$1y1y = \frac{(1.08)^2}{(1.04)} - 1 = \frac{1.1664}{1.04} - 1 = 12.154\%$$

In other words, investors are willing to accept 4.0% on the 1-year bond today (when they could get 8.0% on the 2-year bond today) only because they can get 12.154% on a 1-year bond one year from today. This future rate that can be locked in today is a forward rate.

Similarly, we can back other forward rates out of the spot rates. We know that:

$$(1 + S_3)^3 = (1 + S_1)(1 + 1y1y)(1 + 2y1y)$$

And that:

$$(1 + S_2)^2 = (1 + S_1)(1 + 1y1y), \text{ so we can write } (1 + S_3)^3 = (1 + S_2)^2(1 + 2y1y)$$

This last equation says that investing for three years at the 3-year spot rate should produce the same ending value as investing for two years at the 2-year spot rate, and then for a third year at $2y1y$, the 1-year forward rate, two years from now.

Solving for the forward rate, $2y1y$, we get:

$$\frac{(1+S_3)^3}{(1+S_2)^2} - 1 = 2y1y$$

EXAMPLE: Forward rates from spot rates

Let's extend the previous example to three periods. The current 1-year spot rate is 4.0%, the current 2-year spot rate is 8.0%, and the current 3-year spot rate is 12.0%. Calculate the 1-year forward rates one and two years from now.

Answer:

We know the following relation must hold:

$$(1 + S_2)^2 = (1 + S_1)(1 + 1y1y)$$

We can use it to solve for the 1-year forward rate one year from now:

$$(1.08)^2 = (1.04)(1 + 1y1y), \text{ so } 1y1y = \frac{(1.08)^2}{(1.04)} - 1 = 12.154\%$$

We also know that the relations:

$$(1 + S_3)^3 = (1 + S_1)(1 + 1y1y)(1 + 2y1y)$$

and, equivalently $(1 + S_3)^3 = (1 + S_2)^2(1 + 2y1y)$ must hold.

Substituting values for S_3 and S_2 , we have:

$$(1.12)^3 = (1.08)^2 \times (1 + 2y1y)$$

so that the 1-year forward rate two years from now is:

$$2y1y = \frac{(1.12)^3}{(1.08)^2} - 1 = 20.45\%$$

We can check our results by calculating:

$$S_3 = [(1.04)(1.12154)(1.2045)]^{1/3} - 1 = 12.00\%$$

This may all seem a bit complicated, but the basic relation, that borrowing for successive periods at 1-period rates should have the same cost as borrowing at multiperiod spot rates, can be summed up as:

$$(1 + S_2)^2 = (1 + S_1)(1 + 1y1y) \text{ for two periods, and}$$

$$(1 + S_3)^3 = (1 + S_2)^2(1 + 2y1y) \text{ for three periods.}$$



PROFESSOR'S NOTE

Simple averages also give decent approximations for calculating forward rates from spot rates. In the preceding example, we had spot rates of 4% for one year and 8% for two years. Two years at 8% is 16%, so if the first-year rate is 4%, the second-year rate is close to $16 - 4 = 12\%$ (actual is 12.154). Given a 2-year spot rate of 8% and a 3-year spot rate of 12%, we could approximate the 1-year forward rate from time two to time three as $(3 \times 12) - (2 \times 8) = 20$. That may be close enough (actual is 20.45) to answer a multiple-choice question and, in any case, serves as a good check to make sure the exact rate you calculate is reasonable.

We can also calculate implied forward rates for loans for more than one period. Given spot rates of: 1-year = 5%, 2-year = 6%, 3-year = 7%, and 4-year = 8%, we can calculate 2y2y.

The implied forward rate on a 2-year loan two years from now, 2y2y, is:

$$\left[\frac{(1+S_4)^4}{(1+S_2)^2} \right]^{1/2} - 1 = \left(\frac{1.08^4}{1.06^2} \right)^{1/2} - 1 = 10.04\%.$$



PROFESSOR'S NOTE

The approximation works for multi-period forward rates as well.

The difference between four years at 8% (= 32%) and two years at 6% (= 12%) is 20%. Because that difference is for two years, we divide by two to get an annual rate of 10%, $\frac{(4 \times 8 - 6 \times 2)}{2} = 10$, which is very close to the exact solution of 10.04%.

Valuing a Bond Using Forward Rates

EXAMPLE: Computing a bond value using forward rates

The current 1-year rate, S_1 , is 4%, the 1-year forward rate for lending from time = 1 to time = 2 is $1y1y = 5\%$, and the 1-year forward rate for lending from time = 2 to time = 3 is $2y1y = 6\%$. Value a 3-year annual-pay bond with a 5% coupon and a par value of \$1,000.

Answer:

$$\begin{aligned}\text{bondvalue} &= \frac{50}{1+S_1} + \frac{50}{(1+S_1)(1+1y1y)} + \frac{1,050}{(1+S_1)(1+1y1y)(1+2y1y)} \\ &= \frac{50}{1.04} + \frac{50}{(1.04)(1.05)} + \frac{1,050}{(1.04)(1.05)(1.06)} = \$1,000.98\end{aligned}$$



PROFESSOR'S NOTE

If you think this looks a little like valuing a bond using spot rates, as we did for arbitrage-free valuation, you are correct. The discount factors are equivalent to spot rate discount factors.

If we have a semiannual coupon bond, the calculation methods are the same, but we would use the semiannual discount rate rather than the annualized rate and the number of periods would be the number of semiannual periods.

MODULE 44.5: YIELD SPREADS



LOS 44.k: Compare, calculate, and interpret yield spread measures.

Video covering this content is available online.

CFA® Program Curriculum: Volume 5, page 147

A **yield spread** is the difference between the yields of two different bonds. Yield spreads are typically quoted in basis points.

A yield spread relative to a benchmark bond is known as a **benchmark spread**. For example, if a 5-year corporate bond has a yield of 6.25% and its benchmark, the 5-year Treasury note, has a yield of 3.50%, the corporate bond has a benchmark spread of $625 - 350 = 275$ basis points.

For fixed-coupon bonds, on-the-run government bond yields for the same or nearest maturity are frequently used as benchmarks. The benchmark may change during a bond's life. For a 5-year corporate bond, when issued, the benchmark spread is stated relative to a 5-year government bond yield, but two years later (when it has three years remaining to maturity) its benchmark spread will be stated relative to a 3-year government bond yield. A yield spread over a government bond is also known as a **G-spread**.

An alternative to using government bond yields as benchmarks is to use rates for interest rate swaps in the same currency and with the same tenor as a bond. Yield spreads relative to swap rates are known as **interpolated spreads** or **I-spreads**. I-spreads are frequently stated for bonds denominated in euros.



PROFESSOR'S NOTE

For bonds with tenors that do not match an on-the run government bond, yield spreads may be quoted relative to an "interpolated government bond yield." These are still G-spreads.

As we noted in an earlier topic review, floating-rate securities typically use LIBOR as a benchmark rate.

Yield spreads are useful for analyzing the factors that affect a bond's yield. If a corporate bond's yield increases from 6.25% to 6.50%, this may have been caused by factors that affect all bond yields (macroeconomic factors) or by firm-specific or industry-specific (microeconomic) factors. If a bond's yield increases but its yield spread remains the same, the yield on its benchmark must have also increased, which suggests macroeconomic factors caused bond yields in general to increase. However, if the yield spread increases, this suggests the increase in the bond's yield was caused by microeconomic factors such as credit risk or the issue's liquidity.



PROFESSOR'S NOTE

Recall from our discussion of the Fisher effect in Economics that an interest rate is composed of the real risk-free rate, the expected inflation rate, and a risk premium. We can think of macroeconomic factors as those that affect the real risk-free rate and expected inflation, and microeconomic factors as those that affect the credit and liquidity risk premium.

Zero-Volatility and Option-Adjusted Spreads

A disadvantage of *G*-spreads and *I*-spreads is that they are theoretically correct only if the spot yield curve is flat so that yields are approximately the same across maturities. Normally, however, the spot yield curve is upward-sloping (i.e., longer-term yields are higher than shorter-term yields).

A method for deriving a bond's yield spread to a benchmark spot yield curve that accounts for the shape of the yield curve is to add an equal amount to each benchmark spot rate and value the bond with those rates. When we find an amount which, when added to the benchmark spot rates, produces a value equal to the market price of the bond, we have the appropriate yield curve spread. A yield spread calculated this way is known as a **zero-volatility spread** or **Z-spread**.

EXAMPLE: Zero-volatility spread

The 1-, 2-, and 3-year spot rates on Treasuries are 4%, 8.167%, and 12.377%, respectively. Consider a 3-year, 9% annual coupon corporate bond trading at 89.464. The YTM is 13.50%, and the YTM of a 3-year Treasury is 12%. Compute the *G*-spread and the *Z*-spread of the corporate bond.

Answer:

The *G*-spread is:

$$G\text{-spread} = YTM_{\text{Bond}} - YTM_{\text{Treasury}} = 13.50 - 12.00 = 1.50\%.$$

To compute the *Z*-spread, set the present value of the bond's cash flows equal to today's market price. Discount each cash flow at the appropriate zero-coupon bond spot rate *plus* a fixed spread *ZS*. Solve for *ZS* in the following equation and you have the *Z*-spread:

$$89.464 = \frac{9}{(1.04 + ZS)^1} + \frac{9}{(1.08167 + ZS)^2} + \frac{109}{(1.12377 + ZS)^3}$$

$$\Rightarrow ZS = 1.67\% \text{ or } 167 \text{ basis points}$$

Note that this spread is found by trial-and-error. In other words, pick a number "*ZS*," plug it into the right-hand side of the equation, and see if the result equals 89.464. If the right-hand side equals the left, then you have found the *Z*-spread. If not, adjust "*ZS*" in the appropriate direction and recalculate.

An **option-adjusted spread** (OAS) is used for bonds with embedded options. Loosely speaking, the option-adjusted spread takes the option yield component out of the *Z*-spread

measure; the OAS is the spread to the government spot rate curve that the bond would have if it were option-free.

If we calculate an OAS for a callable bond, it will be less than the bond's Z-spread. The difference is the extra yield required to compensate bondholders for the call option. That extra yield is the option value. Thus, we can write:

$$\text{option value} = \text{Z-spread} - \text{OAS}$$

$$\text{OAS} = \text{Z-spread} - \text{option value}$$

For example, if a callable bond has a Z-spread of 180 bp and the value of the call option is 60 bp, the bond's OAS is $180 - 60 = 120$ bp.



MODULE QUIZ 44.4, 44.5

To best evaluate your performance, enter your quiz answers online.

1. Which of the following yield curves is *least likely* to consist of observed yields in the market?
 - A. Forward yield curve.
 - B. Par bond yield curve.
 - C. Coupon bond yield curve.
2. The 4-year spot rate is 9.45%, and the 3-year spot rate is 9.85%. What is the 1-year forward rate three years from today?
 - A. 8.258%.
 - B. 9.850%.
 - C. 11.059%.
3. Given the following spot and forward rates:
 - Current 1-year spot rate is 5.5%.
 - One-year forward rate one year from today is 7.63%.
 - One-year forward rate two years from today is 12.18%.
 - One-year forward rate three years from today is 15.5%.The value of a 4-year, 10% annual-pay, \$1,000 par value bond is *closest* to:
 - A. \$996.
 - B. \$1,009.
 - C. \$1,086.
4. A corporate bond is quoted at a spread of +235 basis points over an interpolated 12-year U.S. Treasury bond yield. This spread is:
 - A. a G-spread.
 - B. an I-spread.
 - C. a Z-spread.

KEY CONCEPTS

LOS 44.a

The price of a bond is the present value of its future cash flows, discounted at the bond's yield-to-maturity.

For an annual-coupon bond with N years to maturity:

$$\text{price} = \frac{\text{coupon}}{(1+\text{YTM})} + \frac{\text{coupon}}{(1+\text{YTM})^2} + \dots + \frac{\text{coupon} + \text{principal}}{(1+\text{YTM})^N}$$

For a semiannual-coupon bond with N years to maturity:

$$\text{price} = \frac{\text{coupon}}{\left(1 + \frac{\text{YTM}}{2}\right)} + \frac{\text{coupon}}{\left(1 + \frac{\text{YTM}}{2}\right)^2} + \dots + \frac{\text{coupon} + \text{principal}}{\left(1 + \frac{\text{YTM}}{2}\right)^{N \times 2}}$$

LOS 44.b

A bond's price and YTM are inversely related. An increase in YTM decreases the price and a decrease in YTM increases the price.

A bond will be priced at a discount to par value if its coupon rate is less than its YTM, and at a premium to par value if its coupon rate is greater than its YTM.

Prices are more sensitive to changes in YTM for bonds with lower coupon rates and longer maturities, and less sensitive to changes in YTM for bonds with higher coupon rates and shorter maturities.

A bond's price moves toward par value as time passes and maturity approaches.

LOS 44.c

Spot rates are market discount rates for single payments to be made in the future.

The no-arbitrage price of a bond is calculated using (no-arbitrage) spot rates as follows:

$$\text{no-arbitrage price} = \frac{\text{coupon}}{(1+S_1)} + \frac{\text{coupon}}{(1+S_2)^2} + \dots + \frac{\text{coupon} + \text{principal}}{(1+S_N)^N}$$

LOS 44.d

The full price of a bond includes interest accrued between coupon dates. The flat price of a bond is the full price minus accrued interest.

Accrued interest for a bond transaction is calculated as the coupon payment times the portion of the coupon period from the previous payment date to the settlement date.

Methods for determining the period of accrued interest include actual days (typically used for government bonds) or 30-day months and 360-day years (typically used for corporate bonds).

LOS 44.e

Matrix pricing is a method used to estimate the yield-to-maturity for bonds that are not traded or infrequently traded. The yield is estimated based on the yields of traded bonds with the same credit quality. If these traded bonds have different maturities than the bond being valued, linear interpolation is used to estimate the subject bond's yield.

LOS 44.f

The effective yield of a bond depends on its periodicity, or annual frequency of coupon payments. For an annual-pay bond the effective yield is equal to the yield-to-maturity. For bonds with greater periodicity, the effective yield is greater than the yield-to-maturity.

A YTM quoted on a semiannual bond basis is two times the semiannual discount rate.

LOS 44.g

Bond yields that follow street convention use the stated coupon payment dates. A true yield accounts for coupon payments that are delayed by weekends or holidays and may be slightly lower than a street convention yield.

Current yield is the ratio of a bond's annual coupon payments to its price. Simple yield adjusts current yield by using straight-line amortization of any discount or premium.

For a callable bond, a yield-to-call may be calculated using each of its call dates and prices. The lowest of these yields and YTM is a callable bond's yield-to-worst.

Floating rate notes have a *quoted margin* relative to a reference rate, typically LIBOR. The quoted margin is positive for issuers with more credit risk than the banks that quote LIBOR and may be negative for issuers that have less credit risk than loans to these banks. The *required margin* on a floating rate note may be greater than the quoted margin if credit quality has decreased, or less than the quoted margin if credit quality has increased.

LOS 44.h

For money market instruments, yields may be quoted on a discount basis or an add-on basis, and may use 360-day or 365-day years. A bond-equivalent yield is an add-on yield based on a 365-day year.

LOS 44.i

A yield curve shows the term structure of interest rates by displaying yields across different maturities.

The spot curve is a yield curve for single payments in the future, such as zero-coupon bonds or stripped Treasury bonds.

The par curve shows the coupon rates for bonds of various maturities that would result in bond prices equal to their par values.

A forward curve is a yield curve composed of forward rates, such as 1-year rates available at each year over a future period.

LOS 44.j

Forward rates are current lending/borrowing rates for short-term loans to be made in future periods.

A spot rate for a maturity of N periods is the geometric mean of forward rates over the N periods. The same relation can be used to solve for a forward rate given spot rates for two different periods.

To value a bond using forward rates, discount the cash flows at times 1 through N by the product of one plus each forward rate for periods 1 to N , and sum them.

For a 3-year annual-pay bond:

$$\text{price} = \frac{\text{coupon}}{(1+S_1)} + \frac{\text{coupon}}{(1+S_1)(1+1y1y)} + \frac{\text{coupon}+\text{principal}}{(1+S_1)(1+1y1y)(1+2y1y)}$$

LOS 44.k

A yield spread is the difference between a bond's yield and a benchmark yield or yield curve. If the benchmark is a government bond yield, the spread is known as a government spread or *G*-spread. If the benchmark is a swap rate, the spread is known as an interpolated spread or *I*-spread.

A zero-volatility spread or *Z*-spread is the percent spread that must be added to each spot rate on the benchmark yield curve to make the present value of a bond equal to its price.

An option-adjusted spread or *OAS* is used for bonds with embedded options. For a callable bond, the *OAS* is equal to the *Z*-spread minus the call option value in basis points.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 44.1

1. **B** $N = 20$; $I/Y = 15$; $FV = 1,000$; $PMT = 100$; $CPT \rightarrow PV = -\$687.03$. (LOS 44.a)
2. **A** $N = 10$; $I/Y = 7.5$; $FV = 1,000$; $PMT = 50$; $CPT \rightarrow PV = -\$828.40$. (LOS 44.a)
3. **A** The price-yield relationship is inverse. If the required yield decreases, the bond's price will increase, and vice versa. (LOS 44.b)
4. **A** With 20 years to maturity, the value of the bond with an annual-pay yield of 6.5% is $N = 20$, $PMT = 50$, $FV = 1,000$, $I/Y = 6.5$, $CPT \rightarrow PV = -834.72$. With $N = 17$, $CPT \rightarrow PV = -848.34$, so the value will increase \$13.62. (LOS 44.a, 44.b)

Module Quiz 44.2

1. **A** bond value $= \frac{4,000}{1.032} + \frac{4,000}{(1.034)^2} + \frac{104,000}{(1.035)^3} = \$101,419.28$ (LOS 44.c)
2. **B** The full price includes accrued interest, while the flat price does not. Therefore, the flat (or clean) price is $1,059.04 - 23.54 = \$1,035.50$. (LOS 44.d)
3. **C** Using linear interpolation, the yield on a bond with six years to maturity should be $6.40\% + (1/3)(7.20\% - 6.40\%) = 6.67\%$. A bond with a 7% coupon and a yield of 6.67% is at a premium to par value. (LOS 44.e)

Module Quiz 44.3

1. **A** A spot rate is a discount rate for a single future payment. Simple yield is a measure of a bond's yield that accounts for coupon interest and assumes straight-line amortization of a discount or premium. A forward rate is an interest rate for a future period, such as a 3-month rate six months from today. (LOS 44.g)
2. **C** $N = 30$; $FV = 1,000$; $PMT = 0$; $PV = -331.40$; $CPT \rightarrow I/Y = 3.750 \times 2 = 7.500\%$.
Alternatively, $\left[\left(\frac{1,000}{331.4} \right)^{\frac{1}{30}} - 1 \right] \times 2 = 7.5\%$ (LOS 44.g)
3. **C** $N = 4$; $FV = 1,010$; $PMT = 35.625$; $PV = -1,023.47$; $CPT \rightarrow I/Y = 3.167 \times 2 = 6.334\%$. (LOS 44.g)
4. **B** If the required margin is greater than the quoted margin, the credit quality of the issue has decreased and the price on the reset date will be less than par value. (LOS 44.g)
5. **A** An add-on yield based on a 365-day year is a bond-equivalent yield. (LOS 44.h)

Module Quiz 44.4, 44.5

1. **B** Par bond yield curves are based on the theoretical yields that would cause bonds at each maturity to be priced at par. Coupon bond yields and forward interest rates can be observed directly from market transactions. (Module 44.4, LOS 44.i)

2. **A** $(1.0945)^4 = (1.0985)^3 \times (1 + 3y1y)$

$$3y1y = \frac{(1.0945)^4}{(1.0985)^3} - 1 = 8.258\%$$

Approximate forward rate = $4(9.45\%) - 3(9.85\%) = 8.25\%$. (Module 44.4, LOS 44.j)

3. **B** Bond value = $\frac{100}{1.055} + \frac{100}{(1.055)(1.0763)} + \frac{100}{(1.055)(1.0763)(1.1218)}$
 $+ \frac{1,100}{(1.055)(1.0763)(1.1218)(1.155)} = 1,009.03$

(Module 44.4, LOS 44.j)

4. **A** *G*-spreads are quoted relative to an actual or interpolated government bond yield. *I*-spreads are quoted relative to swap rates. *Z*-spreads are calculated based on the shape of the benchmark yield curve. (Module 44.5, LOS 44.k)

The following is a review of the Fixed Income (1) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #45.

READING 45: INTRODUCTION TO ASSET-BACKED SECURITIES

Study Session 14

EXAM FOCUS

In this topic review we introduce asset-backed securities, describing their benefits, legal structure, and characteristics. Our primary focus is residential mortgage-backed securities (RMBS). Candidates should understand the characteristics of mortgage pass-through securities and how and why collateralized mortgage obligations are created from them. Be prepared to compare and contrast agency RMBS, nonagency RMBS, and commercial MBS. Finally, candidates should know why collateralized debt obligations are created and how they differ from the other securitized debt securities covered.

MODULE 45.1: STRUCTURE OF MORTGAGE-BACKED SECURITIES



Video covering this content is available online.

LOS 45.a: Explain benefits of securitization for economies and financial markets.

CFA® Program Curriculum: Volume 5, page 180

Securitization refers to a process by which financial assets (e.g., mortgages, accounts receivable, or automobile loans) are purchased by an entity that then issues securities supported by the cash flows from those financial assets. The primary benefits of the securitization of financial assets are (1) a reduction in funding costs for firms selling the financial assets to the securitizing entity and (2) an increase in the liquidity of the underlying financial assets.

Consider a bank that makes mortgage loans to home buyers and retains and services these loans (i.e., collects the mortgage payments and performs the necessary recordkeeping functions). To gain exposure to a bank's mortgage loans, investors traditionally could only choose among investing in bank deposits, bank debt securities, or the common equity of banks.

Compared to this traditional structure, with the bank serving the function of financial intermediary between borrowers and lenders, securitization can provide the following benefits:

- Securitization reduces intermediation costs, which results in lower funding costs for borrowers and higher risk-adjusted returns for lenders (investors).
- With securitization, the investors' legal claim to the mortgages or other loans is stronger than it is with only a general claim against the bank's overall assets.

- When a bank securitizes its loans, the securities are actively traded, which increases the liquidity of the bank's assets compared to holding the loans.
- By securitizing loans, banks are able to lend more than if they could only fund loans with bank assets. When a loan portfolio is securitized, the bank receives the proceeds, which can then be used to make more loans.
- Securitization has led to financial innovation that allows investors to invest in securities that better match their preferred risk, maturity, and return characteristics. As an example, an investor with a long investment horizon can invest in a portfolio of long-term mortgage loans rather than in only bank bonds, deposits, or equities. The investor can gain exposure to long-term mortgages without having the specialized resources and expertise necessary to provide loan origination and loan servicing functions.
- Securitization provides diversification and risk reduction compared to purchasing individual loans (whole loans).

LOS 45.b: Describe securitization, including the parties involved in the process and the roles they play.

CFA® Program Curriculum: Volume 5, page 181

We can illustrate the basic structure of a *securitization transaction* with this simplified, fictitious example of Fred Motor Company.

Fred Motor Company sells most of its cars on retail sales installment contracts (i.e., auto loans). The customers buy the automobiles, and Fred loans the customers the money for the purchase (i.e., Fred *originates* the loans) with the autos as collateral and receives principal and interest payments on the loans until they mature. The loans have maturities of 48 to 60 months at various interest rates. Fred is also the *servicer* of the loans (i.e., it collects principal and interest payments, sends out delinquency notices, and repossesses and disposes of the autos if the customers do not make timely payments).

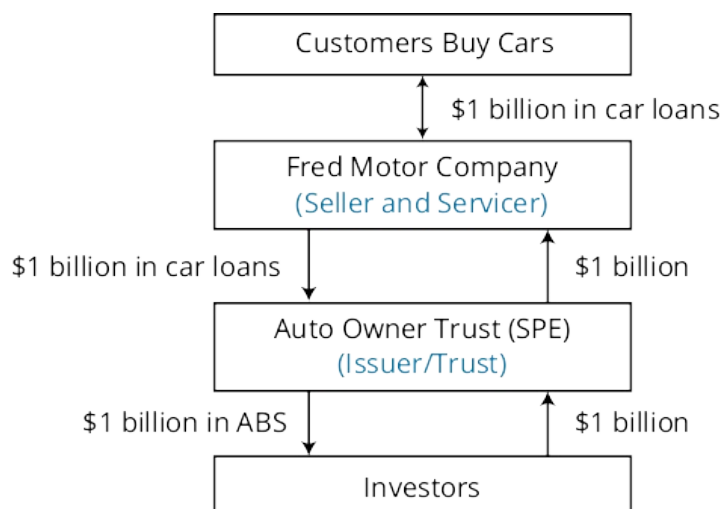
Fred has 50,000 auto loans totaling \$1 billion that it would like to remove from its balance sheet and use the proceeds to make more auto loans. It accomplishes this by selling the loan portfolio to a **special purpose entity** (SPE) called Auto Loan Trust for \$1 billion (Fred is called the *seller* or *depositor*). The SPE, which is set up for the specific purpose of buying these auto loans and selling asset-backed securities (ABS), is referred to as the *trust* or the *issuer*. The SPE then sells ABS to investors. The loan portfolio is the collateral supporting the ABS because the cash flows from the loans are the source of the funds to make the promised payments to investors. An SPE is sometimes also called a special purpose vehicle (SPV). The SPE is a separate legal entity from Fred.

Let's review the parties to this transaction and their functions:

- The seller or depositor (Fred) originates the auto loans and sells the portfolio of loans to Auto Loan Trust, the SPE.
- The issuer/trust (Auto Loan Trust) is the SPE that buys the loans from the seller and issues ABS to investors.
- The servicer (Fred) services the loans.
- In this case, the seller and the servicer are the same entity (Fred Motor Company), but that is not always the case.

The structure of this securitization transaction is illustrated in [Figure 45.1](#).

Figure 45.1: Structure of Fred Motor Company Asset Securitization



Subsequent to the initial transaction, the principal and interest payments on the original loans are allocated to pay servicing fees to the servicer and principal and interest payments to the owners of the ABS. Often there are several classes, or **tranches**, of ABS issued by the trust, each with different priority claims to the cash flows from the underlying loans and different specifications of the payments to be received if the cash flows from the loans are not sufficient to pay all the promised ABS cash flows. This is referred to as *time tranching*. This flow of funds structure is called a **waterfall structure** because each class of ABS (tranche) is paid sequentially, to the extent possible, from the cash flows from the underlying loan portfolio.

ABS are most commonly backed by automobile loans, credit card receivables, home equity loans, manufactured housing loans, student loans, Small Business Administration (SBA) loans, corporate loans, corporate bonds, emerging market bonds, and structured financial products. When the loans owned by the trust (SPE) are mortgages, we refer to the securities issued by the trust as **mortgage-backed securities (MBS)**.

Note that the SPE is a separate legal entity from Fred and the buyers of the ABS have no claim on other assets of Fred, only on the loans sold to the SPE. If Fred had issued corporate bonds to raise the funds to make more auto loans, the bondholders would be subject to the financial risks of Fred. With the ABS structure, a decline in the financial position of Fred, its ability to make cash payments, or its bond rating do not affect the value of the claims of ABS owners to the cash flows from the trust collateral (loan portfolio) because it has been sold by Fred, which is now simply the servicer (not the owner) of the loans. The credit rating of the ABS securities may be higher than the credit rating of bonds issued by Fred, in which case the cost to fund the loans using the ABS structure is lower than if Fred funded additional loans by issuing corporate bonds.

LOS 45.c: Describe typical structures of securitizations, including credit tranching and time tranching.

Securitizations may involve a single class of ABS so the cash flows to the securities are the same for all security holders. They can also be structured with multiple classes of securities, each with a different claim to the cash flows of the underlying assets. The different classes are often referred to as **tranches**. With this structure, a particular risk of the ABS securities is redistributed across the tranches. Some bear more of the risk and others bear less of the risk. The total risk is unchanged, simply reapportioned.

With **credit tranching**, the ABS tranches will have different exposures to the risk of default of the assets underlying the ABS. With this structure, also called a **senior/subordinated structure**, the subordinated tranches absorb credit losses as they occur (up to their principal values). The level of protection for the senior tranche increases with the proportion of subordinated bonds in the structure.

Let's look at an example to illustrate how a senior/subordinated structure redistributes the credit risk compared to a single-class structure. Consider an ABS with the following bond classes:

Senior Tranche	\$300,000,000
Subordinated Tranche A	\$80,000,000
Subordinated Tranche B	<u>\$30,000,000</u>
Total	\$410,000,000

Tranche B is first to absorb any losses (and is termed the *first-loss tranche*) until they exceed \$30 million in principal. Any losses from default of the underlying assets greater than \$30 million, and up to \$110 million, will be absorbed by Subordinated Tranche A. The Senior Tranche is protected from any credit losses of \$110 million or less and therefore will have the highest credit rating and offer the lowest yield of the three bond classes. This structure is also called a **waterfall** structure because in liquidation, each subordinated tranche would receive only the "overflow" from the more senior tranche(s) if they are repaid their principal value in full.

With **time tranching**, the first (sequential) tranche receives all principal repayments from the underlying assets up to the principal value of the tranche. The second tranche would then receive all principal repayments from the underlying assets until the principal value of this tranche is paid off. There may be other tranches with sequential claims to remaining principal repayments. Both credit tranching and time tranching are often included in the same structure. More detail about time tranching and the related planned amortization/support tranche structure is included later in this review when we discuss the structures of mortgage-backed securities.

LOS 45.d: Describe types and characteristics of residential mortgage loans that are typically securitized.

CFA® Program Curriculum: Volume 5, page 190

A **residential mortgage loan** is a loan for which the collateral that underlies the loan is residential real estate. If the borrower defaults on the loan, the lender has a legal claim to the

collateral property. One key characteristic of a mortgage loan is its **loan-to-value ratio** (LTV), the percentage of the value of the collateral real estate that is loaned to the borrower. The lower the LTV, the higher the borrower's equity in the property.

For a lender, loans with lower LTVs are less risky because the borrower has more to lose in the event of default (so is less likely to default). Also, if the property value is high compared to the loan amount, the lender is more likely to recover the amount loaned if the borrower defaults and the lender repossesses and sells the property. In the United States, mortgages with higher LTV ratios, made to borrowers with good credit, are termed *prime loans*. Mortgages to borrowers of lower credit quality, or that have a lower-priority claim to the collateral in event of default, are termed *subprime loans*.

Typical mortgage terms and structures differ across regions and countries. The key characteristics of mortgage loans include their maturity, the determination of interest charges, how the loan principal is amortized, the terms under which prepayments of loan principal are allowed, and the rights of the lender in the event of default by the borrower. We address each of the characteristics in more detail.

Maturity

The term of a mortgage loan is the time until the final loan payment is made. In the United States, mortgage loans typically have terms from 15 to 30 years. Terms are longer, 20 to 40 years, in many European countries and as long as 50 years in others. In Japan, mortgage loans may have terms of 100 years.

Interest rate

A **fixed-rate mortgage** has an interest rate that is unchanged over the life of the mortgage.

An **adjustable-rate mortgage** (ARM), also called a **variable-rate mortgage**, has an interest rate that can change over the life of the mortgage. An **index-referenced mortgage** has an interest rate that changes based on a market determined reference rate such as LIBOR or the one-year U.S. Treasury bill rate, although several other reference rates are used.

A mortgage loan may have an interest rate that is fixed for some initial period, but adjusted after that. If the loan becomes an adjustable-rate mortgage after the initial fixed-rate period it is called a *hybrid mortgage*. If the interest rate changes to a different fixed rate after the initial fixed-rate period it is called a *rollover* or *renegotiable mortgage*.

A **convertible mortgage** is one for which the initial interest rate terms, fixed or adjustable, can be changed at the option of the borrower, to adjustable or fixed, for the remaining loan period.

Amortization of principal

With a **fully amortizing** loan, each payment includes both an interest payment and a repayment of some of the loan principal so there is no loan principal remaining after the last regular mortgage payment. When payments are fixed for the life of the loan, payments in the beginning of the loan term have a large interest component and a small principal repayment component, and payments at the end of the loan terms have a small interest component and large principal repayment component.

A loan is said to be **partially amortizing** when loan payments include some repayment of principal, but there is a lump sum of principal that remains to be paid at the end of the loan period which is called a *balloon payment*. With an **interest-only mortgage**, there is no principal repayment for either an initial period or the life of the loan. If no principal is paid for the life of the loan it is an *interest-only lifetime* mortgage and the balloon payment is the original loan principal amount. Other interest-only mortgages specify that payments are interest-only over some initial period, with partial or full amortization of principal after that.

Prepayment provisions

A partial or full repayment of principal in excess of the scheduled principal repayments required by the mortgage is referred to as a **prepayment**. If a homeowner sells her home during the mortgage term (a common occurrence), repaying the remaining principal is required and is one type of prepayment. A homeowner who *refinances* her mortgage prepays the remaining principal amount using the proceeds of a new, lower interest rate loan. Some homeowners prepay by paying more than their scheduled payments in order to reduce the principal outstanding, reduce their interest charges, and eventually pay off their loans prior to maturity.

Some loans have no penalty for prepayment of principal while others have a **prepayment penalty**. A prepayment penalty is an additional payment that must be made if principal is prepaid during an initial period after loan origination or, for some mortgages, prepaid anytime during the life of the mortgage. A prepayment penalty benefits the lender by providing compensation when the loan is paid off early because market interest rates have decreased since the mortgage loan was made (i.e., loans are refinanced at a lower interest rate).

Foreclosure

Some mortgage loans are **nonrecourse loans**, which means the lender has no claim against the assets of the borrower except for the collateral property itself. When this is the case, if home values fall so the outstanding loan principal is greater than the home value, borrowers sometimes voluntarily return the property to the lender in what is called a *strategic default*.

Other mortgage loans are **recourse loans** under which the lender has a claim against the borrower for the amount by which the sale of a repossessed collateral property falls short of the principal outstanding on the loan. Understandably, borrowers are more likely to default on nonrecourse loans than on recourse loans. In Europe, most residential mortgages are recourse loans. In the United States, they are recourse loans in some states and nonrecourse in others.

LOS 45.e: Describe types and characteristics of residential mortgage-backed securities, including mortgage pass-through securities and collateralized mortgage obligations, and explain the cash flows and risks for each type.

LOS 45.f: Define prepayment risk and describe the prepayment risk of mortgage-backed securities.

CFA® Program Curriculum: Volume 5, page 194

Residential mortgage-backed securities (RMBS) in the United States are termed **agency RMBS** or **nonagency RMBS**, depending on the issuer of the securities. Agency RMBS are issued by the Government National Mortgage Association (GNMA or Ginnie Mae), the Federal National Mortgage Association (Fannie Mae), and the Federal Home Loan Mortgage

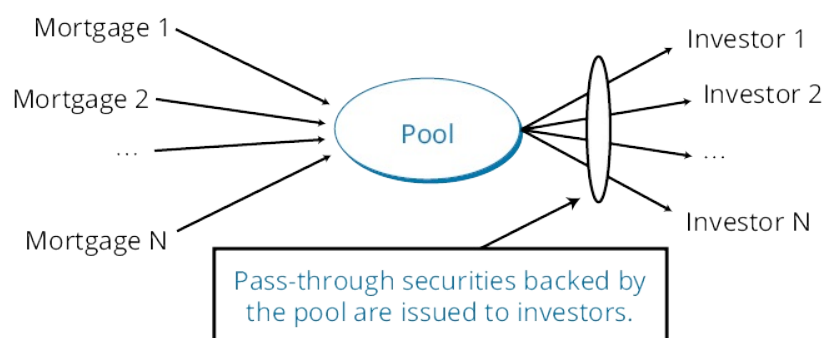
Corporation (Freddie Mac). Ginnie Mae securities are guaranteed by the GNMA and are considered to be backed by the full faith and credit of the U.S. government. Fannie Mae and Freddie Mac also guarantee the MBS they issue but are *government-sponsored enterprises* (GSE). While they are not considered to be backed by the full faith and credit of the U.S. government, these securities are considered to have very high credit quality.

Agency RMBS are **mortgage pass-through securities**. Each mortgage pass-through security represents a claim on the cash flows from a pool of mortgages. Any number of mortgages may be used to form the pool, and any mortgage included in the pool is referred to as a **securitized mortgage**. The mortgages in the pool typically have different maturities and different mortgage rates. The **weighted average maturity** (WAM) of the pool is equal to the weighted average of the final maturities of all the mortgages in the pool, weighted by each mortgage's outstanding principal balance as a proportion of the total outstanding principal value of all the mortgages in the pool. The **weighted average coupon** (WAC) of the pool is the weighted average of the interest rates of all the mortgages in the pool. The investment characteristics of mortgage pass-through securities are a function of their cash flow features and the strength of the guarantee provided.

In order to be included in agency MBS pools, loans must meet certain criteria, including a minimum percentage down payment, a maximum LTV ratio, maximum size, minimum documentation required, and insurance purchased by the borrower. Loans that meet the standards for inclusion in agency MBS are called *conforming loans*. Loans that do not meet the standards are called *nonconforming loans*. Nonconforming mortgages can be securitized by private companies for *nonagency RMBS*.

Investors in mortgage pass-through securities receive the monthly cash flows generated by the underlying pool of mortgages, less any servicing and guarantee/insurance fees. The fees account for the fact that **pass-through rates** (i.e., the coupon rate on the MBS, also called its *net interest* or *net coupon*) are less than the mortgage rate of the underlying mortgages in the pool.

Figure 45.2: Mortgage Pass-Through Cash Flow



The timing of the cash flows to pass-through security holders does not exactly coincide with the cash flows generated by the pool. This is due to the delay between the time the mortgage service provider receives the mortgage payments and the time the cash flows are *passed through* to the security holders.



MODULE QUIZ 45.1

To best evaluate your performance, enter your quiz answers online.

1. Economic benefits of securitization *least likely* include:

- A. reducing excessive lending by banks.
 - B. reducing funding costs for firms that securitize assets.
 - C. increasing the liquidity of the underlying financial assets.
- 2. In a securitization, the issuer of asset-backed securities is *best* described as:
 - A. the SPE.
 - B. the seller.
 - C. the servicer.
- 3. A mortgage-backed security with a senior/subordinated structure is said to feature:
 - A. time tranching.
 - B. credit tranching.
 - C. a pass-through structure.
- 4. A mortgage that has a balloon payment equal to the original loan principal is:
 - A. a convertible mortgage.
 - B. a fully amortizing mortgage.
 - C. an interest-only lifetime mortgage.
- 5. Residential mortgages that may be included in agency RMBS are *least likely* required to have:
 - A. a minimum loan-to-value ratio.
 - B. insurance on the mortgaged property.
 - C. a minimum percentage down payment.
- 6. The primary motivation for issuing collateralized mortgage obligations (CMOs) is to reduce:
 - A. extension risk.
 - B. funding costs.
 - C. contraction risk.

MODULE 45.2: PREPAYMENT RISK AND NON-MORTGAGE-BACKED ABS



Video covering
this content is
available online.

Prepayment Risk

An important characteristic of pass-through securities is their **prepayment risk**. Because the mortgage loans used as collateral for agency MBS have no prepayment penalty, the MBS themselves have significant prepayment risk. Recall that prepayments are principal repayments in excess of the scheduled principal repayments for amortizing loans. The risk that prepayments will be slower than expected is called *extension risk* and the risk that prepayments will be more rapid than expected is called *contraction risk*.

Prepayments cause the timing and amount of cash flows from mortgage loans and MBS to be uncertain; rapid prepayment reduces the amount of principal outstanding on the loans supporting the MBS so the total interest paid over the life of the MBS is reduced. Because of this, it is necessary to make specific assumptions about prepayment rates in order to value mortgage pass-through securities. The single monthly mortality rate (SMM) is the percentage by which prepayments reduce the month-end principal balance, compared to what it would have been with only scheduled principal payments (with no prepayments). The **conditional prepayment rate** (CPR) is an annualized measure of prepayments. Prepayment rates depend on the weighted average coupon rate of the loan pool, current interest rates, and prior prepayments of principal.

The Public Securities Association (PSA) *prepayment benchmark* assumes that the monthly prepayment rate for a mortgage pool increases as it ages (becomes *seasoned*). The PSA benchmark is expressed as a monthly series of CPRs. If the prepayment rate (CPR) of an MBS is expected to be the same as the PSA standard benchmark CPR, we say the PSA is 100

(100% of the benchmark CPR). A pool of mortgages may have prepayment rates that are faster or slower than PSA 100, depending on the current level of interest rates and the coupon rate of the issue. A PSA of 50 means that prepayments are 50% of the PSA benchmark CPR, and a PSA of 130 means that prepayments are 130% of the PSA benchmark CPR.

Based on an assumption about the prepayment rate for an MBS, we can calculate its weighted average life, or simply average life, which is the expected number of years until all the loan principal is repaid. Because of prepayments, the average life of an MBS will be less than its weighted average maturity. During periods of falling interest rates, the refinancing of mortgage loans will accelerate prepayments and reduce the average life of an MBS. A high PSA, such as 400, will reduce the average life of an MBS to only 4.5 years, compared to an average life of about 11 years for an MBS with a PSA of 100.

Collateralized Mortgage Obligations

Collateralized mortgage obligations (CMO) are securities that are collateralized by RMBS. Each CMO has multiple bond classes (CMO tranches) that have different exposures to prepayment risk. The total prepayment risk of the underlying RMBS is not changed; the prepayment risk is simply reapportioned among the various CMO tranches.

Institutional investors have different tolerances for prepayment risk. Some are primarily concerned with extension risk while others may want to minimize exposure to contraction risk. By partitioning and distributing the cash flows generated by RMBS into different risk packages to better match investor preferences, CMOs increase the potential market for securitized mortgages and perhaps reduce funding costs as a result.

CMOs are securities backed by mortgage pass-through securities (i.e., they are securities secured by other securities). Interest and principal payments from the mortgage pass-through securities are allocated in a specific way to different bond classes called tranches, so that each tranche has a different claim against the cash flows of the mortgage pass-throughs. Each CMO tranche has a different mixture of contraction and extension risk. Hence, CMO securities can be more closely matched to the unique asset/liability needs of institutional investors and investment managers.

The primary CMO structures include sequential-pay tranches, planned amortization class tranches (PACs), support tranches, and floating-rate tranches.

Sequential Pay CMO

One way to reapportion the prepayment risk inherent in the underlying pass-through MBS is to separate the cash flows into tranches that are retired sequentially (i.e., create a **sequential pay CMO**). As an example of this structure, we consider a simple CMO with two tranches. Both tranches receive interest payments at a specified coupon rate, but all principal payments (both scheduled payments and prepayments) are paid to Tranche 1 (the *short tranche*) until its principal is paid off. Principal payments then flow to Tranche 2 until its principal is paid off.

Contraction and extension risk still exist with this structure, but they have been redistributed to some extent between the two tranches. The short tranche, which matures first, offers investors relatively more protection against extension risk. The other tranche provides relatively more protection against contraction risk. Let's expand this example with some specific numbers to illustrate how sequential pay structures work.

Consider the simplified CMO structure presented in [Figure 45.3](#). Payments to the two sequential-pay tranches are made first to Tranche A and then to Tranche B.

Figure 45.3: Sequential Pay CMO Structure

CMO Structure		
Tranche	Outstanding Par Value	Coupon Rate
A	\$200,000,000	8.50%
B	50,000,000	8.50%

Payments from the underlying collateral (which has a pass-through coupon rate of 8.5%) for the first five months, as well as months 183 through 187, are shown in [Figure 45.4](#). These payments include scheduled payments plus estimated prepayments based on an assumed prepayment rate. (Note that some totals do not match due to rounding.)

Figure 45.4: CMO Projected Cash Flows

Month	Beginning Principal Balance	Principal Payment	Interest	Total Cash Flow = Principal Plus Interest
1	\$250,000,000	\$391,128	\$1,770,833	\$2,161,961
2	249,608,872	454,790	1,768,063	2,222,853
3	249,154,082	518,304	1,764,841	2,283,145
4	248,635,778	581,620	1,761,170	2,342,790
5	248,054,157	644,690	1,757,050	2,401,741
183	\$51,491,678	\$545,153	\$364,733	\$909,886
184	50,946,525	540,831	360,871	901,702
185	50,405,694	536,542	357,040	893,582
186	49,869,152	532,287	353,240	885,526
187	49,336,866	528,065	349,469	877,534



PROFESSOR'S NOTE

This example is provided as an illustration of how cash flows are allocated to sequential tranches. The LOS does not require you to do the calculations that underlie the numbers in [Figure 45.4](#). The

important point here is how the cash flows are allocated to each tranche.

Planned Amortization Class (PAC) CMO

Another CMO structure has one or more **planned amortization class** (PAC) tranches and **support tranches**. A PAC tranche is structured to make predictable payments, regardless of actual prepayments to the underlying MBS. The PAC tranches have both reduced contraction risk and reduced extension risk compared to the underlying MBS.

Reducing the prepayment risk of the PAC tranches is achieved by increasing the prepayment risk of the CMO's support tranches. If principal repayments are more rapid than expected, the support tranche receives the principal repayments in excess of those specifically allocated to the PAC tranches. Conversely, if the actual principal repayments are slower than expected, principal repayments to the support tranche are curtailed so the scheduled PAC payments can be made. The larger the support tranche(s) relative to the PAC tranches, the smaller the probability that the cash flows to the PAC tranches will differ from their scheduled payments.

For a given CMO structure there are limits to how fast or slow actual prepayment experience can be before the support tranches can no longer either provide or absorb prepayments in the amounts required to keep the PAC payments to their scheduled amounts. The upper and lower bounds on the actual prepayment rates for which the support tranches are sufficient to either provide or absorb actual prepayments in order to keep the PAC principal repayments on schedule are called the **initial PAC collar**.

A PAC may have an initial collar given as 100 – 300 PSA. This means the PAC will make its scheduled payments to investors unless actual prepayment experience is outside these bounds (i.e., above 300 PSA or below 100 PSA). If the prepayment rate is outside of these bounds so payments to a PAC tranche are either sooner or later than promised, the PAC tranche is referred to as a **broken PAC**.

Support tranches have both more contraction risk and more extension risk than the underlying MBS and have a higher promised interest rate than the PAC tranche.

As an example, [Figure 45.5](#) shows the average life for a hypothetical structure that includes a PAC I tranche and a support tranche at various PSA speeds, assuming the PSA speed stays at that level for the entire life of the PAC tranche.

Figure 45.5: Average Life Variability of PAC I Tranche vs. Support Tranche

PSA Speed	PAC I Tranche		Support Tranche
0	13.2		24.0
50	8.8		21.1
100	6.5		17.1
150	6.5	↑	13.3
200	6.5	Initial Collar	10.4
250	6.5	↓	5.2

300	6.5	2.9
350	5.9	2.4
400	5.4	1.8
450	4.6	1.5
500	4.2	1.2

[Figure 45.5](#) illustrates that the PAC I tranche has less prepayment risk than the support tranche because the variability of its average life is significantly lower.

- When prepayment speeds fall and prepayments decrease, the support tranche average life is significantly longer than the average life of the PAC I tranche. Thus, the support tranche has significantly more extension risk.
- When prepayment speeds rise and prepayments increase, the support tranche average life is much shorter than that of the PAC I tranche. Thus, the support tranche also has significantly more contraction risk.
- Within the initial PAC collar of 100 to 300 PSA, the average life of the PAC I tranche is constant at 6.5 years.

Nonagency RMBS

RMBS not issued by GNMA, Fannie Mae, or Freddie Mac are referred to as **nonagency RMBS**. They are not guaranteed by the government, so credit risk is an important consideration. The credit quality of a nonagency MBS depends on the credit quality of the borrowers as well as the characteristics of the loans, such as their LTV ratios. To be investment grade, most nonagency RMBS include some sort of **credit enhancement**. The level of credit enhancement is directly proportional to the credit rating desired by the issuer. Rating agencies determine the exact amount of credit enhancement necessary for an issue to hold a specific rating.

Credit tranching (subordination) is often used to enhance the credit quality of senior RMBS securities. A **shifting interest mechanism** is a method for addressing a decrease in the level of credit protection provided by junior tranches as prepayments or defaults occur in a senior/subordinated structure. If prepayments or credit losses decrease the credit enhancement of the senior securities, the shifting interest mechanism suspends payments to the subordinated securities for a period of time until the credit quality of the senior securities is restored.

LOS 45.g: Describe characteristics and risks of commercial mortgage-backed securities.

CFA® Program Curriculum: Volume 5, page 208

Commercial mortgage-backed securities (CMBS) are backed by income-producing real estate, typically in the form of:

- Apartments (multi-family).
- Warehouses (industrial use property).
- Shopping centers.
- Office buildings.
- Health care facilities.
- Senior housing.
- Hotel/resort properties.

An important difference between residential and commercial MBS is the obligations of the borrowers of the underlying loans. Residential MBS loans are repaid by homeowners; commercial MBS loans are repaid by real estate investors who, in turn, rely on tenants and customers to provide the cash flow to repay the mortgage loan. CMBS mortgages are structured as **nonrecourse loans**, meaning the lender can *only* look to the collateral as a means to repay a delinquent loan if the cash flows from the property are insufficient. In contrast, a residential mortgage lender with recourse can go back to the borrower personally in an attempt to collect any excess of the loan amount above the net proceeds from foreclosing on and selling the property.

For these reasons, the analysis of CMBS securities focuses on the credit risk of the property and not the credit risk of the borrower. The analysis of CMBS structures focuses on two key ratios to assess credit risk.

1. **Debt-to-service-coverage ratio (DSC)** is a basic cash flow coverage ratio of the amount of cash flow from a commercial property available to make debt service payments compared to the required debt service cost.

$$\text{debt-to-service coverage ratio} = \frac{\text{net operating income}}{\text{debt service}}$$

Net operating income (NOI) is calculated after the deduction for real estate taxes but before any relevant income taxes. This ratio, which is typically between one and two, indicates greater protection to the lender when it is higher. Debt service coverage ratios below one indicate that the borrower is not generating sufficient cash flow to make the debt payments and is likely to default. Remember: *the higher the better* for this ratio from the perspective of the lender and the MBS investor.

2. **Loan-to-value ratio** compares the loan amount on the property to its current fair market or appraisal value.

$$\text{loan-to-value ratio} = \frac{\text{current mortgage amount}}{\text{current appraised value}}$$

The lower this ratio, the more protection the mortgage lender has in making the loan. Loan-to-value ratios determine the amount of collateral available, above the loan amount, to provide a cushion to the lender should the property be foreclosed on and sold. Remember: *the lower the better* for this ratio from the perspective of the lender and the MBS investor.

The basic **CMBS structure** is created to meet the risk and return needs of the CMBS investor. As with residential MBS securities, rating organizations such as S&P and Moody's assess the credit risk of each CMBS issue and determine the appropriate credit rating. Each CMBS is segregated into tranches. Losses due to default are first absorbed by the tranche with the lowest priority. Sometimes this most-junior tranche is not rated and is then referred to as the equity tranche, residual tranche, or first-loss tranche.

As with any fixed-rate security, call protection is valuable to the bondholder. In the case of MBS, call protection is equivalent to prepayment protection (i.e., restrictions on the early return of principal through prepayments). CMBS provide call protection in two ways: loan-level call protection provided by the terms of the individual mortgages and call protection provided by the CMBS structure.

There are several means of creating **loan-level call protection**:

- *Prepayment lockout.* For a specific period of time (typically two to five years), the borrower is prohibited from prepaying the mortgage loan.
- *Defeasance.* Should the borrower insist on making principal payments on the mortgage loan, the mortgage loan can be defeased. This is accomplished by using the prepaid principal to purchase a portfolio of government securities that is sufficient to make the remaining required payments on the CMBS. Given the high credit quality of government securities, defeased loans increase the credit quality of a CMBS loan pool.
- *Prepayment penalty points.* A penalty fee expressed in points may be charged to borrowers who prepay mortgage principal. Each point is 1% of the principal amount prepaid.
- *Yield maintenance charges.* The borrower is charged the amount of interest lost by the lender should the loan be prepaid. This *make whole* charge is designed to make lenders indifferent to prepayment, as cash flows are equivalent (at current market rates) whether the loan is prepaid or not.

With all loan call protection programs, any prepayment penalties received are distributed to the CMBS investors in a manner determined by the structure of the CMBS issue.

To create **CMBS-level call protection**, CMBS loan pools are segregated into tranches with a specific sequence of repayment. Those tranches with a higher priority will have a higher credit rating than lower priority tranches because loan defaults will first affect the lower tranches. A wide variety of features can be used to provide call protection to the more senior tranches of the CMBS.

Commercial mortgages are typically amortized over a period longer than the loan term; for example, payments for a 20-year commercial mortgage may be determined based on a 30-year amortization schedule. At the end of the loan term, the loan will still have principal outstanding that needs to be paid; this amount is called a **balloon payment**. If the borrower is unable to arrange refinancing to make this payment, the borrower is in default. This possibility is called balloon risk. The lender will be forced to extend the term of the loan during a workout period, during which time the borrower will be charged a higher interest rate. Because balloon risk entails extending the term of the loan, it is also referred to as extension risk for CMBS.

LOS 45.h: Describe types and characteristics of non-mortgage asset-backed securities, including the cash flows and risks of each type.

CFA® Program Curriculum: Volume 5, page 213

In addition to those backed by mortgages, there are ABS that are backed by various types of financial assets including small business loans, accounts receivable, credit card receivables, automobile loans, home equity loans, and manufactured housing loans. Each of these types of ABS has different risk characteristics and their structures vary to some extent as well. Here

we explain the characteristics of two types, ABS backed by automobile loans and ABS backed by credit card receivables. These two have an important difference in that automobile loans are fully amortizing while credit card receivables are nonamortizing.

Auto Loan ABS

Auto loan-backed securities are backed by loans for automobiles. Auto loans have maturities from 36 to 72 months. Issuers include the financial subsidiaries of auto manufacturers, commercial banks, credit unions, finance companies, and other small financial institutions.

The cash flow components of auto loan-backed securities include interest payments, scheduled principal payments, and prepayments. Auto loans prepay if the cars are sold, traded in, or repossessed. Prepayments also occur if the car is stolen or wrecked and the loan is paid off from insurance proceeds. Finally, the borrower may simply use excess cash to reduce or pay off the loan balance.

Automobile loan ABS all have some sort of credit enhancement to make them attractive to institutional investors. Many have a senior-subordinated structure, with a junior tranche that absorbs credit risk. One or more internal credit enhancement methods, a reserve account, an excess interest spread, or overcollateralization, is also often present in these structures. Just as with mortgages, prime loans refer to those made to borrowers with higher credit ratings and sub-prime loans refers to those made to borrowers with low credit ratings.

Credit Card ABS

Credit card receivable-backed securities are ABS backed by pools of credit card debt owed to banks, retailers, travel and entertainment companies, and other credit card issuers.

The cash flow to a pool of credit card receivables includes finance charges, annual fees, and principal repayments. Credit cards have periodic payment schedules, but because their balances are revolving (i.e., nonamortizing), the principal amount is maintained for a period of time. Interest on credit card ABS is paid periodically, but no principal is paid to the ABS holders during the **lockout period**, which may last from 18 months to 10 years after the ABS are created.

If the underlying credit card holders make principal payments during the lockout period, these payments are used to purchase additional credit card receivables, keeping the overall value of the receivables pool relatively constant. Once the lockout period ends, principal payments are passed through to security holders. Credit card ABS typically have an early (rapid) amortization provision that provides for earlier amortization of principal when it is necessary to preserve the credit quality of the securities.

Interest rates on credit card ABS are sometimes fixed but often they are floating. Interest payments may be monthly, quarterly, or for longer periods.

LOS 45.i: Describe collateralized debt obligations, including their cash flows and risks.

CFA® Program Curriculum: Volume 5, page 217

A **collateralized debt obligation** (CDO) is a structured security issued by an SPE for which the collateral is a pool of debt obligations. When the collateral securities are corporate and emerging market debt, they are called *collateralized bond obligations* (CBO). *Collateralized loan obligations* (CLO) are supported by a portfolio of leveraged bank loans. Unlike the ABS

we have discussed, CDOs do not rely on interest payments from the collateral pool. CDOs have a **collateral manager** who buys and sells securities in the collateral pool in order to generate the cash to make the promised payments to investors.

Structured finance CDOs are those where the collateral is ABS, RMBS, other CDOs, and CMBS.

Synthetic CDOs are those where the collateral is a portfolio of credit default swaps on structured securities.



PROFESSOR'S NOTE

Credit default swaps are derivative securities that decrease (increase) in value as the credit quality of their reference securities increases (decreases).

CDOs issue three classes of bonds (tranches): senior bonds, mezzanine bonds, and subordinated bonds (sometimes called the equity or residual tranche). The subordinated tranche has characteristics more similar to those of equity investments than bond investments. In creating a CDO, the structure must be able to offer an attractive return on the subordinated tranche, after accounting for the required yields on the senior and mezzanine bond classes.

An investment in the equity or residual tranche can be viewed as a leveraged investment where borrowed funds (raised from selling the senior and mezzanine tranches) are used to purchase the debt securities in the CDO's collateral pool. To the extent the collateral manager meets his goal of earning returns in excess of borrowing costs (the promised return to CDO investors), these excess returns are paid to the CDO manager and the equity tranche.

The CDO structure typically is to issue a floating-rate senior tranche that is 70%–80% of the total and a smaller mezzanine tranche that pays a fixed rate of interest. If the securities in the collateral pool pay a fixed rate of interest, the collateral manager may enter into an interest rate swap that pays a floating rate of interest in exchange for a fixed rate of interest in order to make the collateral yield more closely match the funding costs in an environment of changing interest rates. The term *arbitrage CDO* is used for CDOs structured to earn returns from the spread between funding costs and portfolio returns.

The collateral manager may use interest earned on portfolio securities, cash from maturing portfolio securities, and cash from the sale of portfolio securities to cover the promised payments to holders of the CDOs senior and mezzanine bonds.



MODULE QUIZ 45.2

To best evaluate your performance, enter your quiz answers online.

1. The risk that mortgage prepayments will occur more slowly than expected is *best* characterized as:
 - A. default risk.
 - B. extension risk.
 - C. contraction risk.
2. For investors in commercial mortgage-backed securities, balloon risk in commercial mortgages results in:
 - A. call risk.
 - B. extension risk.
 - C. contraction risk.
3. During the lockout period of a credit card ABS:
 - A. no new receivables are added to the pool.
 - B. investors do not receive interest payments.

- C. investors do not receive principal payments.
4. A debt security that is collateralized by a pool of the sovereign debt of several developing countries is *most likely*:
- A. a CMBS.
 - B. a CDO.
 - C. a CMO.

KEY CONCEPTS

LOS 45.a

The primary benefits of the securitization of financial assets are:

- Reduce the funding costs for firms selling the financial assets to the securitizing entity.
- Increase the liquidity of the underlying financial assets.

LOS 45.b

Parties to a securitization are a seller of financial assets, a special purpose entity (SPE), and a servicer.

- The seller is the firm that is raising funds through the securitization.
- An SPE is an entity independent of the seller. The SPE buys financial assets from the seller and issues asset-backed securities (ABS) supported by these financial assets.
- The servicer carries out collections and other responsibilities related to the financial assets. The servicer may be the same entity as the seller but does not have to be.

The SPE may issue a single class of ABS or multiple classes with different priorities of claims to cash flows from the pool of financial assets.

LOS 45.c

Asset-backed securities (ABS) can be a single class of securities or multiple classes with differing claims to the cash flows from the underlying assets. Time tranching refers to classes that receive the principal payments from underlying securities sequentially as each prior tranche is repaid in full. With credit tranching, any credit losses are first absorbed by the tranche with the lowest priority, and after that by any other subordinated tranches, in order. Some structures have both time tranching and credit tranching.

LOS 45.d

Characteristics of residential mortgage loans include:

- Maturity.
- Interest rate: fixed-rate, adjustable-rate, or convertible.
- Amortization: full, partial, or interest-only.
- Prepayment penalties.
- Foreclosure provisions: recourse or nonrecourse.

The loan-to-value (LTV) ratio indicates the percentage of the value of the real estate collateral that is loaned. Lower LTVs indicate less credit risk.

LOS 45.e

Agency residential mortgage-backed securities (RMBS) are guaranteed and issued by GNMA, Fannie Mae, or Freddie Mac. Mortgages that back agency RMBS must be conforming loans that meet certain minimum credit quality standards. Nonagency RMBS are issued by private companies and may be backed by nonconforming mortgages.

Key characteristics of RMBS include:

- Pass-through rate, the coupon rate on the RMBS.
- Weighted average maturity (WAM) and weighted average coupon (WAC) of the underlying pool of mortgages.
- Conditional prepayment rate (CPR), which may be compared to the Public Securities Administration (PSA) benchmark for expected prepayment rates.

Nonagency RMBS typically include credit enhancement. External credit enhancement is a third-party guarantee. Internal credit enhancement includes reserve funds (cash or excess spread), overcollateralization, and senior/subordinated structures.

Collateralized mortgage obligations (CMOs) are collateralized by pools of residential MBS. CMOs are structured with tranches that have different exposures to prepayment risks.

In a sequential-pay CMO, all scheduled principal payments and prepayments are paid to each tranche in sequence until that tranche is paid off. The first tranche to be paid principal has the most contraction risk and the last tranche to be paid principal has the most extension risk.

A planned amortization class (PAC) CMO has PAC tranches that receive predictable cash flows as long as the prepayment rate remains within a predetermined range, and support tranches that have more contraction risk and more extension risk than the PAC tranches.

LOS 45.f

Prepayment risk refers to uncertainty about the timing of the principal cash flows from an ABS. Contraction risk is the risk that loan principal will be repaid more rapidly than expected, typically when interest rates have decreased. Extension risk is the risk that loan principal will be repaid more slowly than expected, typically when interest rates have increased.

LOS 45.g

Commercial mortgage-backed securities (CMBS) are backed by mortgages on income-producing real estate properties. Because commercial mortgages are nonrecourse loans, analysis of CMBS focuses on credit risk of the properties. CMBS are structured in tranches with credit losses absorbed by the lowest priority tranches in sequence.

Call (prepayment) protection in CMBS includes loan-level call protection such as prepayment lockout periods, defeasance, prepayment penalty points, and yield maintenance charges, and CMBS-level call protection provided by the lower-priority tranches.

LOS 45.h

Asset-backed securities may be backed by financial assets other than mortgages. Two examples are auto loan ABS and credit card ABS.

Auto loan ABS are backed by automobile loans, which are typically fully amortizing but with shorter maturities than residential mortgages. Prepayments result when autos are sold or traded in, stolen or wrecked and paid off from insurance proceeds, refinanced, or paid off from the borrower's excess cash.

Credit card ABS are backed by credit card receivables, which are revolving debt (nonamortizing). Credit card ABS typically have a lockout period during which only interest is paid to investors and principal payments on the receivables are used to purchase additional receivables.

LOS 45.i

Collateralized debt obligations (CDOs) are structured securities backed by a pool of debt obligations that is managed by a collateral manager. CDOs include:

- Collateralized bond obligations (CBOs) backed by corporate and emerging market debt.
- Collateralized loan obligations (CLOs) backed by leveraged bank loans.
- Structured finance CDOs backed by residential or commercial MBS, ABS, or other CLOs.
- Synthetic CDOs backed by credit default swaps on structured securities.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 45.1

1. **A** Banks that securitize loans they hold as assets receive cash with which they can make additional loans. The primary benefits of securitization to the economy include reducing firms' funding costs and increasing the liquidity of the financial assets that are securitized. (LOS 45.a)
2. **A** ABS are issued by a special purpose entity (SPE), which is an entity created for that specific purpose. In a securitization, the firm that is securitizing financial assets is described as the seller because it sells the assets to the SPE. The servicer is the entity that deals with collections on the securitized assets. (LOS 45.b)
3. **B** Senior and subordinated tranches are characteristics of a mortgage-backed security with credit tranching. (LOS 45.c)
4. **C** An interest-only lifetime mortgage includes no repayment of principal in its monthly payments so the balloon payment at maturity is equal to the original loan principal. A fully amortizing mortgage has no balloon payment at maturity. A convertible mortgage gives the borrower an option to change the loan from fixed-rate to adjustable-rate or from adjustable-rate to fixed-rate. (LOS 45.d)
5. **A** Conforming loans that may be securitized in agency RMBS have a *maximum* loan-to-value ratio, along with other requirements such as minimum percentage down payments and insurance on the mortgaged property. (LOS 45.e)
6. **B** Issuing CMOs may allow the issuer to raise funds at a lower cost by creating tranches that appeal to investors with different preferences for extension risk and contraction risk. CMOs do not reduce these risks compared to their pool of collateral; they only distribute the risks among the various CMO tranches. (LOS 45.e)

Module Quiz 45.2

1. **B** Extension risk is the risk that prepayments will be slower than expected. Contraction risk is the risk that prepayments will be faster than expected. (LOS 45.e, 45.f)
2. **B** Balloon risk is the possibility that a commercial mortgage borrower will not be able to refinance the principal that is due at the maturity date of the mortgage. This results in a default that is typically resolved by extending the term of the loan during a workout period. Thus, balloon risk is a source of extension risk for CMBS investors. (LOS 45.g)
3. **C** During the lockout period on a credit card receivables-backed ABS, no principal payments are made to investors. (LOS 45.h)
4. **B** A collateralized debt obligation (CDO) is backed by an underlying pool of debt securities, which may include emerging markets debt. Both collateralized mortgage obligations and commercial mortgage-backed securities are backed by mortgages only. (LOS 45.i)

The following is a review of the Fixed Income (2) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #46.

READING 46: UNDERSTANDING FIXED-INCOME RISK AND RETURN

Study Session 15

EXAM FOCUS

“Risk” in the title of this topic review refers primarily to risk arising from uncertainty about future interest rates. Measurement of credit risk is addressed in the following topic review. That said, there is a significant amount of testable material covered in this review. Calculations required by the learning outcomes include the sources of bond returns, three duration measures, money duration, the price value of a basis point, and approximate convexity. You must also be able to estimate a bond’s price change for a given change in yield based on its duration and convexity. Important concepts include how bond characteristics affect interest rate risk, factors that affect a bond’s reinvestment risk, and the interaction among price risk, reinvestment risk, and the investment horizon.

MODULE 46.1: SOURCES OF RETURNS, DURATION



Video covering this content is available online.

LOS 46.a: Calculate and interpret the sources of return from investing in a fixed-rate bond.

CFA® Program Curriculum: Volume 5, page 241

There are **three sources of returns** from investing in a fixed-rate bond:

1. Coupon and principal payments.
2. Interest earned on coupon payments that are reinvested over the investor’s holding period for the bond.
3. Any capital gain or loss if the bond is sold prior to maturity.

We will assume that a bond makes all of its promised coupon and principal payments on time (i.e., we are not addressing credit risk). Additionally, we assume that the *interest rate earned on reinvested coupon payments is the same as the YTM on the bond*. There are five results to gain from the analysis presented here.

Given the assumptions just listed:

1. An investor who holds a fixed-rate bond to maturity will earn an annualized rate of return equal to the YTM of the bond when purchased.
2. An investor who sells a bond prior to maturity will earn a rate of return equal to the YTM at purchase if the YTM at sale has not changed since purchase.
3. If the market YTM for the bond, our assumed reinvestment rate, increases (decreases) after the bond is purchased but before the first coupon date, a buy-and-hold investor’s

realized return will be higher (lower) than the YTM of the bond when purchased.

4. If the market YTM for the bond, our assumed reinvestment rate, *increases* after the bond is purchased but before the first coupon date, a bond investor will earn a rate of return that is lower than the YTM at bond purchase if the bond is held for a *short* period.
5. If the market YTM for the bond, our assumed reinvestment rate, *decreases* after the bond is purchased but before the first coupon date, a bond investor will earn a rate of return that is lower than the YTM at bond purchase if the bond is held for a *long* period.

We will present mathematical examples to demonstrate each of these results as well as some intuition as to why these results must hold.

A bond investor's **annualized holding period rate of return** is calculated as the compound annual return earned from the bond over the investor's holding period. This is the compound rate of return that, based on the purchase price of the bond, would provide an amount at the time of the sale or maturity of the bond equal to the sum of coupon payments, sale or maturity value, and interest earned on reinvested coupons.

We will illustrate this calculation (and the first result listed earlier) with a 6% annual-pay three-year bond purchased at a YTM of 7% and held to maturity.

With an annual YTM of 7%, the bond's purchase price is \$973.76.

$$N = 3; I/Y = 7; PMT = 60; FV = 1,000; CPT \rightarrow PV = -973.76$$

At maturity, the investor will have received coupon income and reinvestment income equal to the future value of an annuity of three \$60 coupon payments calculated with an interest rate equal to the bond's YTM. This amount is

$$60(1.07)^2 + 60(1.07) + 60 = \$192.89$$

$$N = 3; I/Y = 7; PV = 0; PMT = 60; CPT \rightarrow FV = -192.89$$

We can easily calculate the amount earned from reinvestment of the coupons as

$$192.89 - 3(60) = \$12.89$$

Adding the maturity value of \$1,000 to \$192.89, we can calculate the investor's rate of return over the three-year holding period as $\left(\frac{1,192.89}{973.76}\right)^{\frac{1}{3}} - 1 = 7\%$ and demonstrate that \$973.76 invested at a compound annual rate of 7% would return \$1,192.89 after three years.

We can calculate an investor's rate of return on the same bond purchased at a YTM of 5%.

Price at purchase:

$$N = 3; I/Y = 5; FV = 1,000; PMT = 60; CPT \rightarrow PV = -1,027.23$$

Coupons and reinvestment income:

$$60(1.05)^2 + 60(1.05) + 60 = \$189.15 \text{ or}$$

$$N = 3; I/Y = 5; PV = 0; PMT = 60; CPT \rightarrow FV = -189.15$$

Holding period return:

$$\left(\frac{1,189.15}{1,027.23} \right)^{\frac{1}{3}} - 1 = 5\%$$

With these examples, we have demonstrated our first result: that for a fixed-rate bond that does not default and has a reinvestment rate equal to the YTM, an investor who holds the bond until maturity will earn a rate of return equal to the YTM at purchase, regardless of whether the bond is purchased at a discount or a premium.

The intuition is straightforward. If the bond is selling at a discount, the YTM is greater than the coupon rate because together, the amortization of the discount and the higher assumed reinvestment rate on coupon income increase the bond's return. For a bond purchased at a premium, the YTM is less than the coupon rate because both the amortization of the premium and the reduction in interest earned on reinvestment of its cash flows decrease the bond's return.

Now let's examine the second result—that an investor who sells a bond prior to maturity will earn a rate of return equal to the YTM as long as the YTM has not changed since purchase. For such an investor, we call the time the bond will be held the investor's **investment horizon**. The value of a bond that is sold at a discount or premium to par will move to the par value of the bond by the maturity date. At dates between the purchase and the sale, the value of a bond at the same YTM as when it was purchased is its **carrying value** and reflects the amortization of the discount or premium since the bond was purchased.



PROFESSOR'S NOTE

Carrying value is a price along a bond's constant-yield price trajectory. We applied this concept in Financial Reporting and Analysis when we used the effective interest method to calculate the carrying value of a bond liability.

Capital gains or losses at the time a bond is sold are measured relative to this carrying value, as illustrated in the following example.

EXAMPLE: Capital gain or loss on a bond

An investor purchases a 20-year bond with a 5% semiannual coupon and a yield to maturity of 6%. Five years later the investor sells the bond for a price of 91.40. Determine whether the investor realizes a capital gain or loss, and calculate its amount.

Answer:

Any capital gain or loss is based on the bond's carrying value at the time of sale, when it has 15 years (30 semiannual periods) to maturity. The carrying value is calculated using the bond's YTM at the time the investor purchased it.

$$N = 30; I/Y = 3; PMT = 2.5; FV = 100; CPT \rightarrow PV = -90.20$$

Because the selling price of 91.40 is greater than the carrying value of 90.20, the investor realizes a capital gain of $91.40 - 90.20 = 1.20$ per 100 of face value.

Bonds held to maturity have no capital gain or loss. Bonds sold prior to maturity at the same YTM as at purchase will also have no capital gain or loss. Using the 6% three-year bond from our earlier examples, we can demonstrate this for an investor with a two-year holding period (investment horizon).

When the bond is purchased at a YTM of 7% (for \$973.76), we have:

Price at sale: (at end of year 2, YTM = 7%):

$$1,060 / 1.07 = 990.65 \text{ or}$$

$$N = 1; I/Y = 7; FV = 1,000; PMT = 60; CPT \rightarrow PV = -990.65$$

which is the carrying value of the bond.

Coupon interest and reinvestment income for two years:

$$60(1.07) + 60 = \$124.20 \text{ or}$$

$$N = 2; I/Y = 7; PV = 0; PMT = 60; CPT \rightarrow FV = -124.20$$

Investor's annual compound rate of return over the two-year holding period is:

$$\left(\frac{124.20 + 990.65}{973.76} \right)^{\frac{1}{2}} - 1 = 7\%$$

This result can be demonstrated for the case where the bond is purchased at a YTM of 5% (\$1,027.23) as well:

Price at sale (at end of year 2, YTM = 5%):

$$1,060 / 1.05 = 1,009.52 \text{ or}$$

$$N = 1; I/Y = 5; FV = 1,000; PMT = 60; CPT \rightarrow PV = -1,009.52$$

which is the carrying value of the bond.

Coupon interest and reinvestment income for two years:

$$60(1.05) + 60 = 123.00 \text{ or}$$

$$N = 2; I/Y = 5; PV = 0; PMT = 60; CPT \rightarrow FV = -123.00$$

Investor's annual compound rate of return over the two-year holding period is:

$$\left(\frac{123.00 + 1,009.52}{1,027.23} \right)^{\frac{1}{2}} - 1 = 5\%$$

For a bond investor with an investment horizon less than the bond's term to maturity, the annual holding period return will be equal to the YTM at purchase (under our assumptions), if the bond is sold at that YTM. The intuition here is that if a bond will have a rate of return equal to its YTM at maturity, which we showed, if we sell some of the remaining value of the bond discounted at that YTM, we will have earned that YTM up to the date of sale.

Now let's examine our third result: that if rates rise (fall) before the first coupon date, an investor who holds a bond to maturity will earn a rate of return greater (less) than the YTM at purchase.

Based on our previous result that an investor who holds a bond to maturity will earn a rate of return equal to the YTM at purchase if the reinvestment rate is also equal to the YTM at purchase, the intuition of the third result is straightforward. If the YTM, which is also the reinvestment rate for the bond, increases (decreases) after purchase, the return from coupon payments and reinvestment income will increase (decrease) as a result and increase (decrease) the investor's rate of return on the bond above (below) its YTM at purchase. The following calculations demonstrate these results for the three-year 6% bond in our previous examples.

For a three-year 6% bond purchased at par (YTM of 6%), first assume that the YTM and reinvestment rate increases to 7% after purchase but before the first coupon payment date.

The bond's annualized holding period return is calculated as:

Coupons and reinvestment interest:

$$60(1.07)^2 + 60(1.07) + 60 = \$192.89$$

$$N = 3; I/Y = 7; PV = 0; PMT = 60; CPT \rightarrow FV = -192.89$$

Investor's annual compound holding period return:

$$\left(\frac{1,192.89}{1,000} \right)^{\frac{1}{3}} - 1 = 6.06\%$$

which is greater than the 6% YTM at purchase.

If the YTM decreases to 5% after purchase but before the first coupon date, we have the following.

Coupons and reinvestment interest:

$$60(1.05)^2 + 60(1.05) + 60 = \$189.15$$

$$N = 3; I/Y = 5; PV = 0; PMT = 60; CPT \rightarrow FV = -189.15$$

Investor's annual compound holding period return:

$$\left(\frac{1,189.15}{1,000} \right)^{\frac{1}{3}} - 1 = 5.94\%$$

which is less than the 6% YTM at purchase.

Note that in both cases, the investor's rate of return is between the YTM at purchase and the assumed reinvestment rate (the new YTM).

We now turn our attention to the fourth and fifth results concerning the effects of the length of an investor's holding period on the rate of return for a bond that experiences an increase or decrease in its YTM before the first coupon date.

We have already demonstrated that when the YTM increases (decreases) after purchase but before the first coupon date, an investor who holds the bond to maturity will earn a rate of return greater (less) than the YTM at purchase. Now, we examine the rate of return earned by an investor with an investment horizon (expected holding period) less than the term to maturity under the same circumstances.

Consider a three-year 6% bond purchased at par by an investor with a one-year investment horizon. If the YTM increases from 6% to 7% after purchase and the bond is sold after one year, the rate of return can be calculated as follows.

Bond price just after first coupon has been paid with YTM = 7%:

$$N = 2; I/Y = 7; FV = 1,000; PMT = 60; CPT \rightarrow PV = -981.92$$

There is no reinvestment income and only one coupon of \$60 received so the holding period rate of return is simply:

$$\left(\frac{981.92 + 60}{1,000} \right) - 1 = 4.19\%$$

which is less than the YTM at purchase.

If the YTM *decreases* to 5% after purchase and the bond is sold at the end of one year, the investor's rate of return can be calculated as follows.

Bond price just after first coupon has been paid with YTM = 5%:

$$N = 2; I/Y = 5; FV = 1,000; PMT = 60; CPT \rightarrow PV = -1,018.59$$

And the holding period rate of return is simply:

$$\left(\frac{1,018.59 + 60}{1,000} \right) - 1 = 7.86\%$$

which is greater than the YTM at purchase.

The intuition of this result is based on the idea of a trade-off between **market price risk** (the uncertainty about price due to uncertainty about market YTM) and **reinvestment risk** (uncertainty about the total of coupon payments and reinvestment income on those payments due to the uncertainty about future reinvestment rates).

Previously, we showed that for a bond held to maturity, the investor's rate of return increased with an increase in the bond's YTM and decreased with a decrease in the bond's YTM. For an investor who intends to hold a bond to maturity, there is no interest rate risk as we have defined it. Assuming no default, the bond's value at maturity is its par value regardless of interest rate changes so that the investor has only reinvestment risk. Her realized return will increase when interest earned on reinvested cash flows increases, and decrease when the reinvestment rate decreases.

For an investor with a short investment horizon, interest rate risk increases and reinvestment risk decreases. For the investor with a one-year investment horizon, there was no reinvestment risk because the bond was sold before any interest on coupon payments was earned. The investor had only market price risk so an increase in yield decreased the rate of return over the one-year holding period because the sale price is lower. Conversely, a decrease in yield increased the one-year holding period return to more than the YTM at purchase because the sale price is higher.

To summarize:

short investment horizon: market price risk > reinvestment risk

long investment horizon: reinvestment risk > market price risk

LOS 46.b: Define, calculate, and interpret Macaulay, modified, and effective durations.

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Macaulay Duration

Duration is used as a measure of a bond's interest rate risk or sensitivity of a bond's *full* price to a change in its yield. The measure was first introduced by Frederick Macaulay and his formulation is referred to as **Macaulay duration**.

A bond's (annual) Macaulay duration is calculated as the weighted average of the number of years until each of the bond's promised cash flows is to be paid, where the weights are the present values of each cash flow as a percentage of the bond's full value.

Consider a newly issued three-year 4% annual-pay bond with a yield to maturity of 5%. The present values of each of the bond's promised payments, discounted at 5%, and their weights in the calculation of Macaulay duration, are shown in the following table.

$C_1 = 40$	$PV_1 = 40 / 1.05$	$=$	38.10	$W_1 = 38.10 / 972.77$	$=$	0.0392
$C_2 = 40$	$PV_2 = 40 / 1.05^2$	$=$	36.28	$W_2 = 36.28 / 972.77$	$=$	0.0373
$C_3 = 1,040$	$PV_3 = 1,040 / 1.05^3$	$=$	<u>898.39</u>	$W_3 = 898.39 / 972.77$	$=$	<u>0.9235</u>
972.77				1.0000		

Note that the present values of all the promised cash flows sum to 972.77 (the full value of the bond) and the weights sum to 1.

Now that we have the weights, and because we know the time until each promised payment is to be made, we can calculate the Macaulay duration for this bond:

$$0.0392(1) + 0.0373(2) + 0.9235(3) = 2.884 \text{ years}$$

The Macaulay duration of a semiannual-pay bond can be calculated in the same way: as a weighted average of the number of *semiannual periods* until the cash flows are to be received. In this case, the result is the number of semiannual periods rather than years.

Because of the improved measures of interest rate risk described next, we say that Macaulay duration is the weighted-average time to the receipt of principal and interest payments, rather than our best estimate of interest rate sensitivity. Between coupon dates, the Macaulay duration of a coupon bond decreases with the passage of time and then goes back up significantly at each coupon payment date.

Modified Duration

Modified duration (ModDur) is calculated as Macaulay duration (MacDur) divided by one plus the bond's yield to maturity. For the bond in our earlier example, we have:

$$\text{ModDur} = 2.884 / 1.05 = 2.747$$

Modified duration provides an approximate percentage change in a bond's price for a 1% change in yield to maturity. The price change for a given change in yield to maturity can be calculated as:

$$\text{approximate percentage change in bond price} = -\text{ModDur} \times \Delta\text{YTM}$$

Based on a ModDur of 2.747, the price of the bond should fall by approximately $2.747 \times 0.1\% = 0.2747\%$ in response to a 0.1% increase in YTM. The resulting price estimate of \$970.098 is very close to the value of the bond calculated directly using a YTM of 5.1%, which is \$970.100.

For an annual-pay bond, the general form of modified duration is:

$$\text{ModDur} = \text{MacDur} / (1 + \text{YTM})$$

For a semiannual-pay bond with a YTM quoted on a semiannual bond basis:

$$\text{ModDur}_{\text{SEMI}} = \text{MacDur}_{\text{SEMI}} / (1 + \text{YTM} / 2)$$

This modified duration can be annualized (from semiannual periods to annual periods) by dividing by two, and then used as the approximate change in price for a 1% change in a bond's YTM.

Approximate Modified Duration

We can approximate modified duration directly using bond values for an increase in YTM and for a decrease in YTM of the same size.

In [Figure 46.1](#) we illustrate this method. The calculation of approximate modified duration is based on a given change in YTM. V_- is the price of the bond if YTM is *decreased* by ΔYTM and V_+ is the price of the bond if the YTM is *increased* by ΔYTM . Note that $V_- > V_+$.

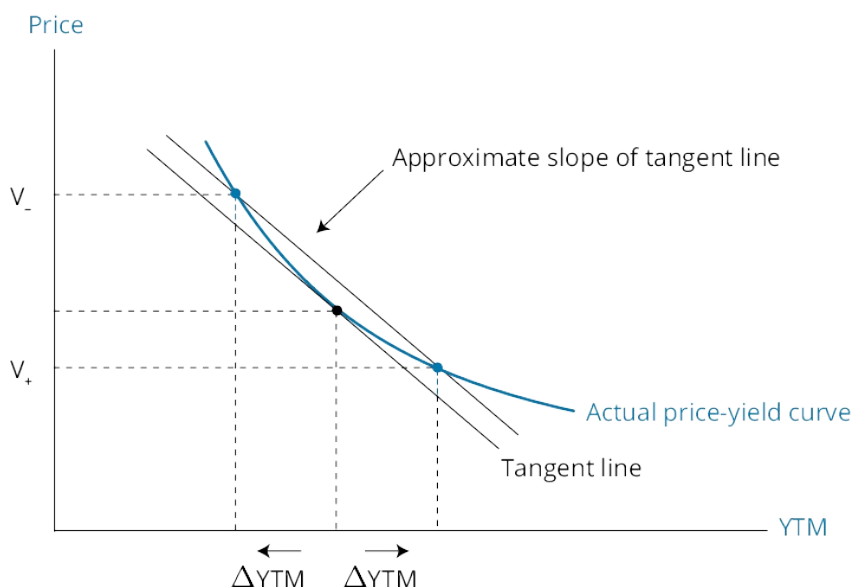
Because of the convexity of the price-yield relationship, the price increase (to V_-), for a given decrease in yield, is larger than the price decrease (to V_+).

$$\text{approximate modified duration} = \frac{V_- - V_+}{2 \times V_0 \times \Delta\text{YTM}}$$

The formula uses the average of the magnitudes of the price increase and the price decrease, which is why $V_- - V_+$ (in the numerator) is divided by 2 (in the denominator).

V_0 , the current price of the bond, is in the denominator to convert this average price change to a percentage, and the ΔYTM term is in the denominator to scale the duration measure to a 1% change in yield by convention. Note that the ΔYTM term in the denominator must be entered as a decimal (rather than in a whole percentage) to properly scale the duration estimate.

Figure 46.1: Approximate Modified Duration



EXAMPLE: Calculating approximate modified duration

A bond is trading at a full price of 980. If its yield to maturity increases by 50 basis points, its price will decrease to 960. If its yield to maturity decreases by 50 basis points, its price will increase to 1,002. Calculate the approximate modified duration.

Answer:

The approximate modified duration is $\frac{1,002-960}{2 \times 980 \times 0.005} = 4.29$, and the approximate change in price for a 1% change in YTM is 4.29%.

Note that modified duration is a *linear estimate* of the relation between a bond's price and YTM, whereas the actual relation is convex, not linear. This means that the modified duration measure provides good estimates of bond prices for small changes in yield, but increasingly poor estimates for larger changes in yield as the effect of the curvature of the price-yield curve is more pronounced.

Effective Duration

So far, all of our duration measures have been calculated using the YTM and prices of straight (option-free) bonds. This is straightforward because both the future cash flows and their timing are known with certainty. This is not the case with bonds that have embedded options, such as a callable bond or a mortgage-backed bond.

We say mortgage-backed bonds have a *prepayment option*, which is similar to a call option on a corporate bond. The borrowers (people who take out mortgages) typically have the option to pay off the principal value of their loans, in whole or in part, at any time. These prepayments accelerate when interest rates fall significantly because borrowers can refinance their home loans at a lower rate and pay off the remaining principal owed on an existing loan.

Thus, the pricing of bonds with embedded put, call, or prepayment options begins with the benchmark yield curve, not simply the current YTM of the bond. The appropriate measure of interest rate sensitivity for these bonds is **effective duration**.

The calculation of effective duration is the same as the calculation of approximate modified duration with the change in YTM, Δy , replaced by Δ_{curve} , the change in the benchmark yield curve used with a bond pricing model to generate V_- and V_+ . The formula for calculating effective duration is:

$$\text{effective duration} = \frac{V_- - V_+}{2 \times V_0 \times \Delta_{\text{curve}}}$$

Another difference between calculating effective duration and the methods we have discussed so far is that the effects of changes in benchmark yields and changes in the yield spread for credit and liquidity risk are separated. Modified duration makes no distinction between changes in the benchmark yield and changes in the spread. Effective duration reflects only the sensitivity of the bond's value to changes in the benchmark yield curve. Changes in the credit spread are sometimes addressed with a separate "credit duration" measure.

Finally, note that unlike modified duration, effective duration does not necessarily provide better estimates of bond prices for smaller changes in yield. It may be the case that larger changes in yield produce more predictable prepayments or calls than small changes.

LOS 46.c: Explain why effective duration is the most appropriate measure of interest rate risk for bonds with embedded options.

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For bonds with embedded options, the future cash flows depend not only on future interest rates but also on the path that interest rates take over time (did they fall to a new level or rise

to that level?). We must use effective duration to estimate the interest rate risk of these bonds. The effective duration measure must also be based on bond prices from a pricing model. The fact that bonds with embedded options have uncertain future cash flows means that our present value calculations for bond value based on YTM cannot be used.



MODULE QUIZ 46.1

To best evaluate your performance, enter your quiz answers online.

1. The largest component of returns for a 7-year zero-coupon bond yielding 8% and held to maturity is:
 - A. capital gains.
 - B. interest income.
 - C. reinvestment income.
2. An investor buys a 10-year bond with a 6.5% annual coupon and a YTM of 6%. Before the first coupon payment is made, the YTM for the bond decreases to 5.5%. Assuming coupon payments are reinvested at the YTM, the investor's return when the bond is held to maturity is:
 - A. less than 6.0%.
 - B. equal to 6.0%.
 - C. greater than 6.0%.
3. Assuming coupon interest is reinvested at a bond's YTM, what is the interest portion of an 18-year, \$1,000 par, 5% annual coupon bond's return if it is purchased at par and held to maturity?
 - A. \$576.95
 - B. \$1,406.62.
 - C. \$1,476.95.
4. An investor buys a 15-year, £800,000, zero-coupon bond with an annual YTM of 7.3%. If she sells the bond after three years for £346,333 she will have:
 - A. a capital gain.
 - B. a capital loss.
 - C. neither a capital gain nor a capital loss.
5. A 14% annual-pay coupon bond has six years to maturity. The bond is currently trading at par. Using a 25 basis point change in yield, the approximate modified duration of the bond is closest to:
 - A. 0.392.
 - B. 3.888.
 - C. 3.970.
6. Which of the following measures is lowest for a callable bond?
 - A. Macaulay duration.
 - B. Effective duration.
 - C. Modified duration.
7. Effective duration is more appropriate than modified duration for estimating interest rate risk for bonds with embedded options because these bonds:
 - A. tend to have greater credit risk than option-free bonds.
 - B. exhibit high convexity that makes modified duration less accurate.
 - C. have uncertain cash flows that depend on the path of interest rate changes.

MODULE 46.2: INTEREST RATE RISK AND MONEY DURATION



Video covering this content is available online.

LOS 46.d: Define key rate duration and describe the use of key rate durations in measuring the sensitivity of bonds to changes in the shape of the benchmark yield curve.

Recall that duration is an adequate measure of bond price risk only for parallel shifts in the yield curve. The impact of nonparallel shifts can be measured using a concept known as **key rate duration**. A key rate duration, also known as a **partial duration**, is defined as the sensitivity of the value of a bond or portfolio to changes in the spot rate for a specific maturity, holding other spot rates constant. A bond or portfolio will have a key rate duration for each maturity range on the spot rate curve.

Key rate duration is particularly useful for measuring the effect of a nonparallel shift in the yield curve on a bond portfolio. We can use the key rate duration for each maturity to compute the effect on the portfolio of the interest rate change at that maturity. The effect on the overall portfolio is the sum of these individual effects.

LOS 46.e: Explain how a bond's maturity, coupon, and yield level affect its interest rate risk.

Other things equal, an *increase in a bond's maturity* will (usually) increase its interest rate risk. The present values of payments made further in the future are more sensitive to changes in the discount rate used to calculate present value than are the present values of payments made sooner.

We must say “usually” because there are instances where an increase in a discount coupon bond's maturity will decrease its Macaulay duration. For a discount bond, duration first increases with longer maturity and then decreases over a range of relatively long maturities until it approaches the duration of a perpetuity, which is $(1 + \text{YTM}) / \text{YTM}$.

Other things equal, an *increase in the coupon rate* of a bond will decrease its interest rate risk. For a given maturity and YTM, the duration of a zero coupon bond will be greater than that of a coupon bond. Increasing the coupon rate means more of a bond's value will be from payments received sooner so that the value of the bond will be less sensitive to changes in yield.

Other things equal, an *increase (decrease) in a bond's YTM* will decrease (increase) its interest rate risk. To understand this, we can look to the convexity of the price-yield curve and use its slope as our proxy for interest rate risk. At lower yields, the price-yield curve has a steeper slope indicating that price is more sensitive to a given change in yield.

Adding either a put or a call provision will decrease a straight bond's interest rate risk as measured by effective duration. With a call provision, the value of the call increases as yields fall, so a decrease in yield will have less effect on the price of the bond, which is the price of a straight bond minus the value of the call option held by the issuer. With a put option, the bondholder's option to sell the bond back to the issuer at a set price reduces the negative impact of yield increases on price.

LOS 46.f: Calculate the duration of a portfolio and explain the limitations of portfolio duration.

There are two approaches to estimating the duration of a portfolio. The first is to calculate the weighted average number of periods until the portfolio's cash flows will be received. The second approach is to take a weighted average of the durations of the individual bonds in the portfolio.

The first approach is theoretically correct but not often used in practice. The yield measure for calculating portfolio duration with this approach is the **cash flow yield**, the IRR of the bond portfolio. This is inconsistent with duration capturing the relationship between YTM and price. This approach will not work for a portfolio that contains bonds with embedded options because the future cash flows are not known with certainty and depend on interest rate movements.

The second approach is typically used in practice. Using the durations of individual portfolio bonds makes it possible to calculate the duration for a portfolio that contains bonds with embedded options by using their effective durations. The weights for the calculation of portfolio duration under this approach are simply the full price of each bond as a proportion of the total portfolio value (using full prices). These proportions of total portfolio value are multiplied by the corresponding bond durations to get portfolio duration.

$$\text{portfolio duration} = W_1 D_1 + W_2 D_2 + \dots + W_N D_N$$

where:

W_i = full price of bond i divided by the total value of the portfolio

D_i = the duration of bond i

N = the number of bonds in the portfolio

One limitation of this approach is that for portfolio duration to “make sense” the YTM of every bond in the portfolio must change by the same amount. Only with this assumption of a **parallel shift** in the yield curve is portfolio duration calculated with this approach consistent with the idea of the percentage change in portfolio value per 1% change in YTM.

We can think of the second approach as a practical approximation of the theoretically correct duration that the first approach describes. This approximation is less accurate when there is greater variation in yields among portfolio bonds, but is the same as the portfolio duration under the first approach when the yield curve is flat.

LOS 46.g: Calculate and interpret the money duration of a bond and price value of a basis point (PVBP).

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The **money duration** of a bond position (also called *dollar duration*) is expressed in currency units.

$$\text{money duration} = \text{annual modified duration} \times \text{full price of bond position}$$

Money duration is sometimes expressed as money duration per 100 of bond par value.

$$\text{money duration per 100 units of par value} = \text{annual modified duration} \times \text{full bond price per 100 of par value}$$

Multiplying the money duration of a bond times a given change in YTM (as a decimal) will provide the change in bond value for that change in YTM.

EXAMPLE: Money duration

1. Calculate the money duration on a coupon date of a \$2 million par value bond that has a modified duration of 7.42 and a full price of 101.32, expressed for the whole bond and per \$100 of face value.
2. What will be the impact on the value of the bond of a 25 basis points increase in its YTM?

Answer:

1. The money duration for the bond is modified duration times the full value of the bond:
 $7.42 \times \$2,000,000 \times 101.32 = \$15,035,888$
The money duration per \$100 of par value is:
 $7.42 \times 101.32 = \$751.79$
Or, $\$15,035,888 / (\$2,000,000 / \$100) = \751.79
2. $\$15,035,888 \times 0.0025 = \$37,589.72$
The bond value decreases by \$37,589.72.

The **price value of a basis point (PVBP)** is the money change in the full price of a bond when its YTM changes by one basis point, or 0.01%. We can calculate the PVBP directly for a bond by calculating the average of the decrease in the full value of a bond when its YTM increases by one basis point and the increase in the full value of the bond when its YTM decreases by one basis point.

EXAMPLE: Calculating the price value of a basis point

A newly issued, 20-year, 6% annual-pay straight bond is priced at 101.39. Calculate the price value of a basis point for this bond assuming it has a par value of \$1 million.

Answer:

First we need to find the YTM of the bond:

$$N = 20; PV = -101.39; PMT = 6; FV = 100; CPT \rightarrow I/Y = 5.88$$

Now we need the values for the bond with YTM's of 5.89 and 5.87.

$$I/Y = 5.89; CPT \rightarrow PV = -101.273 (V_+)$$

$$I/Y = 5.87; CPT \rightarrow PV = -101.507 (V_-)$$

$$PVBP \text{ (per \$100 of par value)} = (101.507 - 101.273) / 2 = 0.117$$

For the \$1 million par value bond, each 1 basis point change in the yield to maturity will change the bond's price by $0.117 \times \$1 \text{ million} \times 0.01 = \$1,170$.

**MODULE QUIZ 46.2**

To best evaluate your performance, enter your quiz answers online.

1. A bond portfolio manager who wants to estimate the sensitivity of the portfolio's value to changes in the 5-year spot rate should use:
 - A. a key rate duration.
 - B. a Macaulay duration.
 - C. an effective duration.
2. Which of the following three bonds (similar except for yield and maturity) has the *least* Macaulay duration? A bond with:
 - A. 5% yield and 10-year maturity.
 - B. 5% yield and 20-year maturity.
 - C. 6% yield and 10-year maturity.

3. Portfolio duration has limited usefulness as a measure of interest rate risk for a portfolio because it:
 - A. assumes yield changes uniformly across all maturities.
 - B. cannot be applied if the portfolio includes bonds with embedded options.
 - C. is accurate only if the portfolio's internal rate of return is equal to its cash flow yield.
4. The current price of a \$1,000, 7-year, 5.5% semiannual coupon bond is \$1,029.23. The bond's price value of a basis point is *closest* to:
 - A. \$0.05.
 - B. \$0.60.
 - C. \$5.74.

MODULE 46.3: CONVEXITY AND YIELD VOLATILITY



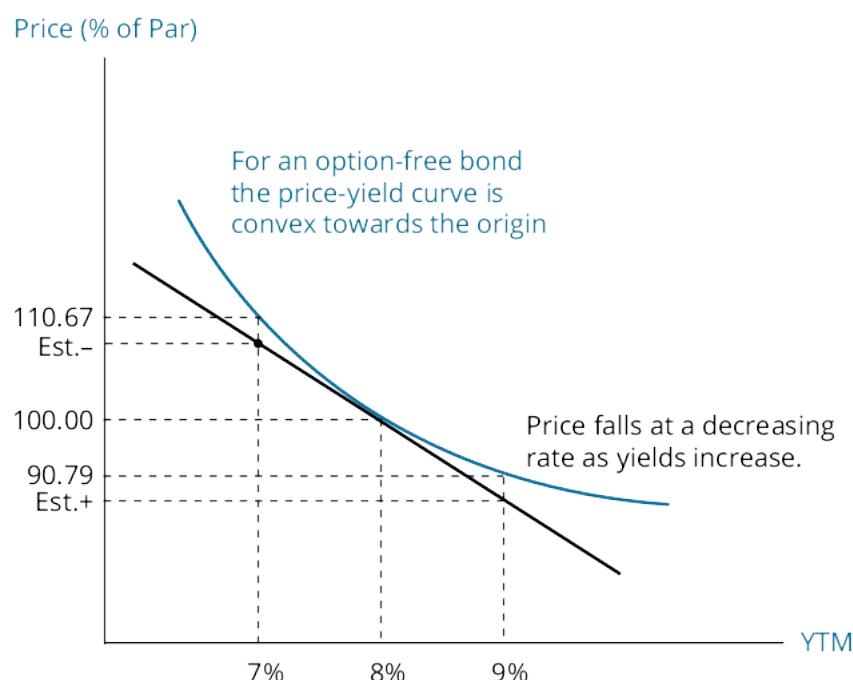
Video covering this content is available online.

LOS 46.h: Calculate and interpret approximate convexity and distinguish between approximate and effective convexity.

CFA® Program Curriculum: Volume 5, page 269

Earlier we explained that modified duration is a linear approximation of the relationship between yield and price and that, because of the convexity of the true price-yield relation, duration-based estimates of a bond's full price for a given change in YTM will be increasingly different from actual prices. This is illustrated in [Figure 46.2](#). Duration-based price estimates for a decrease and for an increase in YTM are shown as Est.₋ and Est.₊.

Figure 46.2: Price-Yield Curve for an Option-Free, 8%, 20-Year Bond



Estimates of the price impact of a change in yield based only on modified duration can be improved by introducing a second term based on the bond's convexity. **Convexity** is a measure of the curvature of the price-yield relation. The more curved it is, the greater the convexity adjustment to a duration-based estimate of the change in price for a given change in YTM.

A bond's convexity can be estimated as:

$$\text{approximate convexity} = \frac{V_- + V_+ - 2V_0}{(\Delta YTM)^2 V_0}$$

where:

the variables are the same as those we used in calculating approximate modified duration

Effective convexity, like effective duration, must be used for bonds with embedded options.

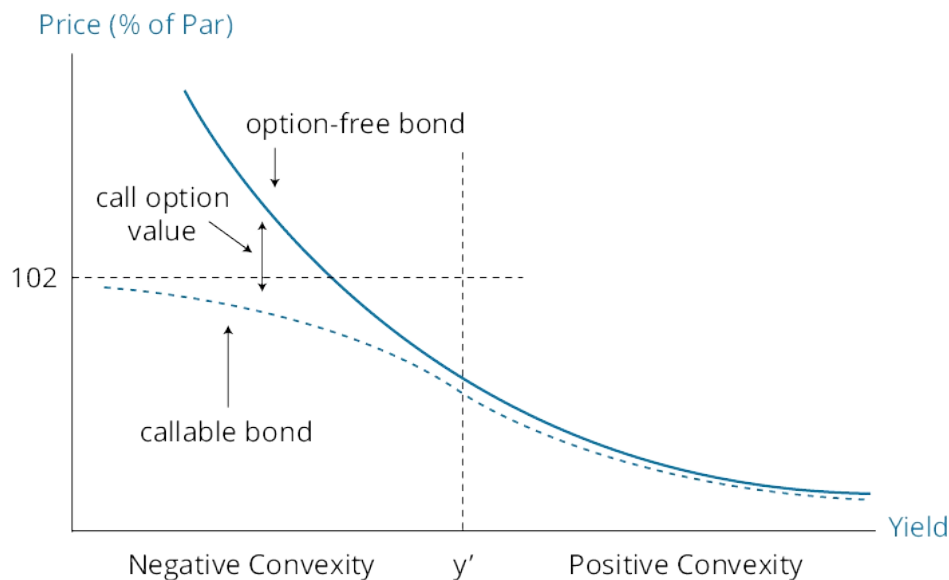
The calculation of effective convexity is the same as the calculation of approximate convexity, except that the change in the yield *curve*, rather than a change in the bond's YTM, is used.

$$\text{approximate effective convexity} = \frac{V_- + V_+ - 2V_0}{(\Delta \text{curve})^2 V_0}$$

A bond's convexity is increased or decreased by the same bond characteristics that affect duration. A longer maturity, a lower coupon rate, or a lower yield to maturity will all increase convexity, and vice versa. For two bonds with equal duration, the one with cash flows that are more dispersed over time will have the greater convexity.

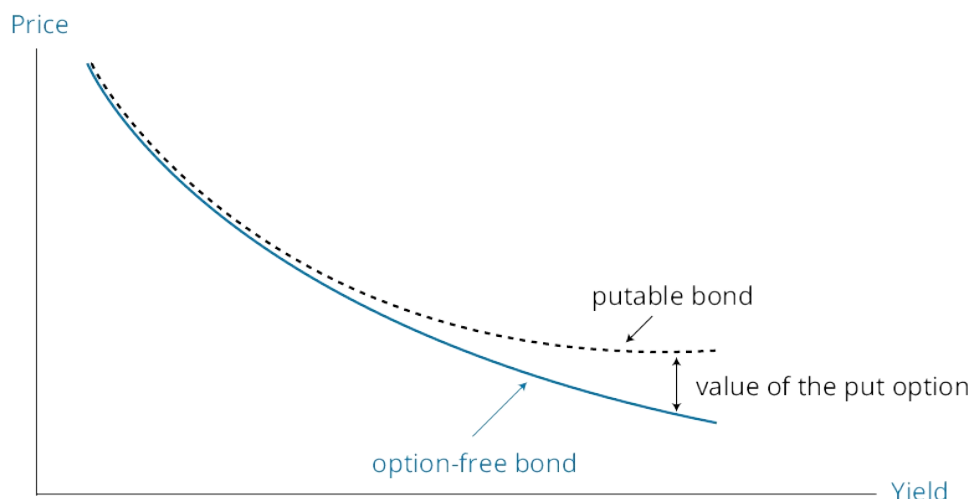
While the convexity of any option-free bond is positive, the convexity of a callable bond can be negative at low yields. This is because at low yields the call option becomes more valuable and the call price puts an effective limit on increases in bond value as shown in [Figure 46.3](#). For a bond with negative convexity, the price increase from a decrease in YTM is *smaller* than the price decrease from an increase in YTM.

Figure 46.3: Price-Yield Function of a Callable vs. an Option-Free Bond



A puttable bond has greater convexity than an otherwise identical option-free bond. In [Figure 46.4](#) we illustrate the price-yield relation for a puttable bond. At higher yields, the put becomes more valuable so that the value of the puttable bond falls less than that of an option-free bond as yield increases.

Figure 46.4: Comparing the Price-Yield Curves for Option-Free and Puttable Bonds



LOS 46.i: Estimate the percentage price change of a bond for a specified change in yield, given the bond's approximate duration and convexity.

CFA® Program Curriculum: Volume 5, page 270

By taking account of both a bond's duration (first-order effects) and convexity (second-order effects), we can improve an estimate of the effects of a change in yield on a bond's value, especially for larger changes in yield.

$$\text{change in full bond price} = -\text{annual modified duration}(\Delta\text{YTM}) + \frac{1}{2} \text{annual convexity}(\Delta\text{YTM})^2$$

EXAMPLE: Estimating price changes with duration and convexity

Consider an 8% bond with a full price of \$908 and a YTM of 9%. Estimate the percentage change in the full price of the bond for a 30 basis point increase in YTM assuming the bond's duration is 9.42 and its convexity is 68.33.

Answer:

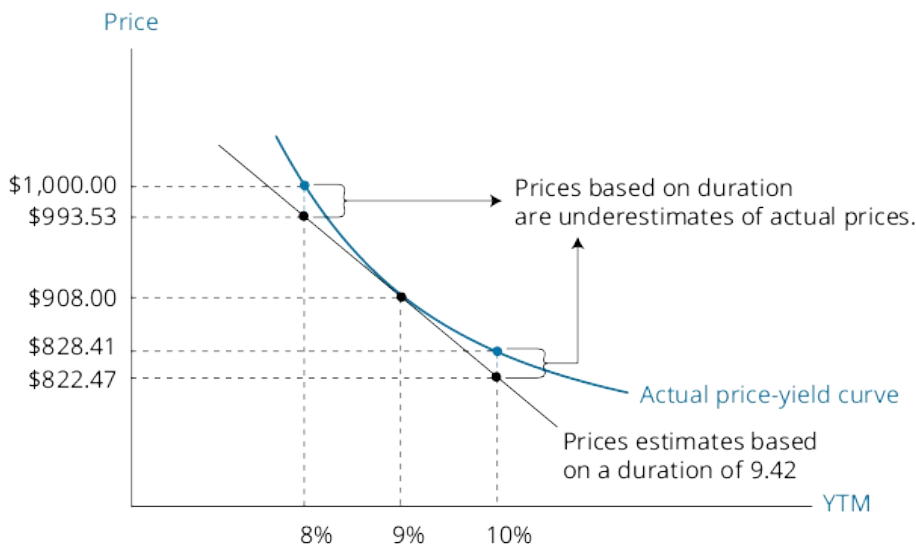
The duration effect is $-9.42 \times 0.003 = 0.02826 = -2.826\%$.

The convexity effect is $0.5 \times 68.33 \times (0.003)^2 = 0.000307 = 0.0307\%$.

The expected change in bond price is $(-0.02826 + 0.000307) = -2.7953\%$.

Note that the convexity adjustment to the price change is the same for both an increase and a decrease in yield. As illustrated in [Figure 46.5](#), the duration-only based estimate of the increase in price resulting from a decrease in yield is too low for a bond with positive convexity, and is improved by a positive adjustment for convexity. The duration-only based estimate of the decrease in price resulting from an increase in yield is larger than the actual decrease, so it's also improved by a positive adjustment for convexity.

Figure 46.5: Duration-Based Price Estimates vs. Actual Bond Prices



LOS 46.j: Describe how the term structure of yield volatility affects the interest rate risk of a bond.

CFA® Program Curriculum: Volume 5, page 278

The **term structure of yield volatility** refers to the relation between the volatility of bond yields and their times to maturity. We have seen that the sensitivity of a bond's price with respect to a *given* change in yield depends on its duration and convexity. From an investor's point of view, it's the volatility of a bond's price that is of concern. The volatility of a bond's price has two components: the sensitivity of the bond's price to a given change in yield and the volatility of the bond's yield.

In calculating duration and convexity, we implicitly assumed that the yield curve shifted in a parallel manner. In practice, this is often not the case. For example, changes in monetary policy may have more of an effect on short-term interest rates than on longer-term rates.

It could be the case that a shorter-term bond has more price volatility than a longer-term bond with a greater duration because of the greater volatility of the shorter-term yield.

LOS 46.k: Describe the relationships among a bond's holding period return, its duration, and the investment horizon.

CFA® Program Curriculum: Volume 5, page 279

Macaulay duration has an interesting application in matching a bond to an investor's investment horizon. When the investment horizon and the bond's Macaulay duration are matched, a parallel shift in the yield curve prior to the first coupon payment will not (or will minimally) affect the investor's horizon return.

Earlier, we illustrated the effect of a change in yield that occurs prior to the first coupon payment. Our results showed that for an investor with a short investment horizon (anticipated holding period), the market price risk of the bond outweighs its reinvestment risk. Because of this, an increase in yield prior to the first coupon date was shown to reduce the horizon yield for a short investment horizon and increase the horizon yield for a longer-term investment horizon. For a longer investment horizon, the increase in reinvestment income from the yield increase was greater than the decrease in the sale price of the bond.

For a decrease in yield, an investor with a short investment horizon will have a capital gain and only a small decrease in reinvestment income. An investor with a long horizon will be more affected by the decrease in reinvestment income and will have a horizon return that is less than the bond's original yield.

When the investment horizon just matches the Macaulay duration, the effect of a change in YTM on the sale price of a bond and on reinvestment income just offset each other. We can say that for such an investment, market price risk and reinvestment risk offset each other. The following example illustrates this result.

EXAMPLE: Investment horizon yields

Consider an eight-year, 8.5% bond priced at 89.52 to yield 10.5% to maturity. The Macaulay duration of the bond is 6. We can calculate the horizon yield for horizons of 3 years, 6 years, and 8 years, assuming the YTM falls to 9.5% prior to the first coupon date.

Answer:

Sale after 3 years

Bond price:

$$N = 5; PMT = 8.5; FV = 100; I/Y = 9.5; CPT \rightarrow PV = 96.16$$

Coupons and interest on reinvested coupons:

$$N = 3; PMT = 8.5; PV = 0; I/Y = 9.5; CPT \rightarrow FV = 28.00$$

Horizon return:

$$[(96.16 + 28.00) / 89.52]^{1/3} - 1 = 11.520\%$$

Sale after 6 years

Bond price:

$$N = 2; PMT = 8.5; FV = 100; I/Y = 9.5; CPT \rightarrow PV = 98.25$$

Coupons and interest on reinvested coupons:

$$N = 6; PMT = 8.5; PV = 0; I/Y = 9.5; CPT \rightarrow FV = 64.76$$

Horizon return:

$$[(98.25 + 64.76) / 89.52]^{1/6} - 1 = 10.505\%$$

Held to maturity, 8 years

Maturity value = 100

Coupons and interest on reinvested coupons:

$$N = 8; PMT = 8.5; PV = 0; I/Y = 9.5; CPT \rightarrow FV = 95.46$$

Horizon return:

$$[(100 + 95.46) / 89.52]^{1/8} - 1 = 10.253\%$$

For an investment horizon equal to the bond's Macaulay duration of 6, the horizon return is equal to the original YTM of 10.5%. For a shorter three-year investment horizon, the price increase from a reduction in the YTM to 9.5% dominates the decrease in reinvestment income so the horizon return, 11.520%, is greater than the original YTM. For an investor who holds the bond to maturity, there is no price effect and the decrease in reinvestment income reduces the horizon return to 10.253%, less than the original YTM.

The difference between a bond's Macaulay duration and the bondholder's investment horizon is referred to as a **duration gap**. A positive duration gap (Macaulay duration greater than the investment horizon) exposes the investor to market price risk from increasing interest rates. A negative duration gap (Macaulay duration less than the investment horizon) exposes the investor to reinvestment risk from decreasing interest rates.

LOS 46.I: Explain how changes in credit spread and liquidity affect yield-to-maturity of a bond and how duration and convexity can be used to estimate the price effect of the changes.

CFA® Program Curriculum: Volume 5, page 284

The benchmark yield curve's interest rates have two components; the real rate of return and expected inflation. A bond's spread to the benchmark curve also has two components, a premium for credit risk and a premium for lack of liquidity relative to the benchmark securities.

Because we are treating the yields associated with each component as additive, a given increase or decrease in any of these components of yield will increase or decrease the bond's YTM by the same amount.

With a direct relationship between a bond's yield spread to the benchmark yield curve and its YTM, we can estimate the impact on a bond's value of a change in spread using the formula we introduced earlier for the price effects of a given change in YTM.

$$\% \Delta \text{ bond value} = -\text{duration}(\Delta \text{spread}) + \frac{1}{2} \text{convexity}(\Delta \text{spread})^2$$

EXAMPLE: Price effect of spread changes

Consider a bond that is valued at \$180,000 that has a duration of 8 and a convexity of 22. The bond's spread to the benchmark curve increases by 25 basis points due to a credit downgrade. What is the approximate change in the bond's market value?

Answer:

With $\Delta \text{spread} = 0.0025$ we have:

$$(-8 \times 0.0025) + (0.5 \times 22 \times 0.0025^2) = -1.99\% \text{ and the bond's value will fall by approximately } 1.99\% \times 180,000 = \$3,588.$$



MODULE QUIZ 46.3

To best evaluate your performance, enter your quiz answers online.

1. A bond has a convexity of 114.6. The convexity effect, if the yield decreases by 110 basis points, is *closest* to:
 - A. -1.673%.
 - B. +0.693%.
 - C. +1.673%.
2. The modified duration of a bond is 7.87. The approximate percentage change in price using duration only for a yield decrease of 110 basis points is *closest* to:
 - A. -8.657%.
 - B. +7.155%.
 - C. +8.657%.
3. Assume a bond has an effective duration of 10.5 and a convexity of 97.3. Using both of these measures, the estimated percentage change in price for this bond, in response to a

decline in yield of 200 basis points, is *closest* to:

- A. 19.05%.
 - B. 22.95%.
 - C. 24.89%.
4. Two bonds are similar in all respects except maturity. Can the shorter-maturity bond have greater interest rate risk than the longer-term bond?
- A. No, because the shorter-maturity bond will have a lower duration.
 - B. Yes, because the shorter-maturity bond may have a higher duration.
 - C. Yes, because short-term yields can be more volatile than long-term yields.
5. An investor with an investment horizon of six years buys a bond with a modified duration of 6.0. This investment has:
- A. no duration gap.
 - B. a positive duration gap.
 - C. a negative duration gap.
6. Which of the following *most accurately* describes the relationship between liquidity and yield spreads relative to benchmark government bond rates? All else being equal, bonds with:
- A. less liquidity have lower yield spreads.
 - B. greater liquidity have higher yield spreads.
 - C. less liquidity have higher yield spreads.

KEY CONCEPTS

LOS 46.a

Sources of return from a bond investment include:

- Coupon and principal payments.
- Reinvestment of coupon payments.
- Capital gain or loss if bond is sold before maturity.

Changes in yield to maturity produce market price risk (uncertainty about a bond's price) and reinvestment risk (uncertainty about income from reinvesting coupon payments). An increase (a decrease) in YTM decreases (increases) a bond's price but increases (decreases) its reinvestment income.

LOS 46.b

Macaulay duration is the weighted average number of coupon periods until a bond's scheduled cash flows.

Modified duration is a linear estimate of the percentage change in a bond's price that would result from a 1% change in its YTM.

$$\text{approximate modified duration} = \frac{V_- - V_+}{2V_0 \Delta \text{YTM}}$$

Effective duration is a linear estimate of the percentage change in a bond's price that would result from a 1% change in the benchmark yield curve.

$$\text{effective duration} = \frac{V_- - V_+}{2V_0 \Delta \text{curve}}$$

LOS 46.c

Effective duration is the appropriate measure of interest rate risk for bonds with embedded options because changes in interest rates may change their future cash flows. Pricing models are used to determine the prices that would result from a given size change in the benchmark yield curve.

LOS 46.d

Key rate duration is a measure of the price sensitivity of a bond or a bond portfolio to a change in the spot rate for a specific maturity. We can use the key rate durations of a bond or portfolio to estimate its price sensitivity to changes in the shape of the yield curve.

LOS 46.e

Holding other factors constant:

- Duration increases when maturity increases.
- Duration decreases when the coupon rate increases.
- Duration decreases when YTM increases.

LOS 46.f

There are two methods for calculating portfolio duration:

- Calculate the weighted average number of periods until cash flows will be received using the portfolio's IRR (its cash flow yield). This method is better theoretically but cannot be used for bonds with options.
- Calculate the weighted average of durations of bonds in the portfolio (the method most often used). Portfolio duration is the percentage change in portfolio value for a 1% change in yield, only for parallel shifts of the yield curve.

LOS 46.g

Money duration is stated in currency units and is sometimes expressed per 100 of bond value.

money duration = annual modified duration × full price of bond position

money duration per 100 units of par value = annual modified duration × full bond price per 100 of par value

The price value of a basis point is the change in the value of a bond, expressed in currency units, for a change in YTM of one basis point, or 0.01%.

$$PVBP = [(V_- - V_+) / 2] \times \text{par value} \times 0.01$$

LOS 46.h

Convexity refers to the curvature of a bond's price-yield relationship.

$$\text{approximate convexity} = \frac{V_- + V_+ - 2V_0}{(\Delta YTM)^2 V_0}$$

Effective convexity is appropriate for bonds with embedded options:

$$\text{approximate effective convexity} = \frac{V_- + V_+ - 2V_0}{(\Delta \text{curve})^2 V_0}$$

LOS 46.i

Given values for approximate annual modified duration and approximate annual convexity, the percentage change in the full price of a bond can be estimated as:

$$\% \Delta \text{ full bond price} = -\text{annual modified duration}(\Delta YTM) + \frac{1}{2} \text{ annual convexity}(\Delta YTM)^2$$

LOS 46.j

The term structure of yield volatility refers to the relationship between maturity and yield volatility. Short-term yields may be more volatile than long-term yields. As a result, a short-term bond may have more price volatility than a longer-term bond with a higher duration.

LOS 46.k

Over a short investment horizon, a change in YTM affects market price more than it affects reinvestment income.

Over a long investment horizon, a change in YTM affects reinvestment income more than it affects market price.

Macauley duration may be interpreted as the investment horizon for which a bond's market price risk and reinvestment risk just offset each other.

$$\text{duration gap} = \text{Macauley duration} - \text{investment horizon}$$

LOS 46.l

A bond's yield spread to the benchmark curve includes a premium for credit risk and a premium for illiquidity.

Given values for duration and convexity, the effect on the value of a bond from a given change in its yield spread (Δspread) can be estimated as:

$$-\text{duration}(\Delta\text{spread}) + \frac{1}{2} \text{convexity}(\Delta\text{spread})^2$$

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 46.1

- B** The increase in value of a zero-coupon bond over its life is interest income. A zero-coupon bond has no reinvestment risk over its life. A bond held to maturity has no capital gain or loss. (LOS 46.a)
- A** The decrease in the YTM to 5.5% will decrease the reinvestment income over the life of the bond so that the investor will earn less than 6%, the YTM at purchase. (LOS 46.a)
- B** The interest portion of a bond's return is the sum of the coupon payments and interest earned from reinvesting coupon payments over the holding period.
 $N = 18; PMT = 50; PV = 0; I/Y = 5\%; CPT \rightarrow FV = -1,406.62$
 (LOS 46.a)
- A** The price of the bond after three years that will generate neither a capital gain nor a capital loss is the price if the YTM remains at 7.3%. After three years, the present value of the bond is $800,000 / 1.073^{12} = 343,473.57$, so she will have a capital gain relative to the bond's carrying value. (LOS 46.a)
- B** $V_- = 100.979$
 $N = 6; PMT = 14.00; FV = 100; I/Y = 13.75; CPT \rightarrow PV = -100.979$
 $V_+ = 99.035$
 $I/Y = 14.25; CPT \rightarrow PV = -99.035V_0 = 100.000$
 $\Delta y = 0.0025$

$$\text{Approximate modified duration} = \frac{V_- - V_+}{2V_0 \Delta YTM} = \frac{100.979 - 99.035}{2(100)(0.0025)} = 3.888$$

 (LOS 46.b)
- B** The interest rate sensitivity of a bond with an embedded call option will be less than that of an option-free bond. Effective duration takes the effect of the call option into account and will, therefore, be less than Macaulay or modified duration. (LOS 46.b)
- C** Because bonds with embedded options have cash flows that are uncertain and depend on future interest rates, effective duration must be used. (LOS 46.c)

Module Quiz 46.2

- A** Key rate duration refers to the sensitivity of a bond or portfolio value to a change in one specific spot rate. (LOS 46.d)
- C** Other things equal, Macaulay duration is less when yield is higher and when maturity is shorter. The bond with the highest yield and shortest maturity must have the lowest Macaulay duration. (LOS 46.e)

3. **A** Portfolio duration is limited as a measure of interest rate risk because it assumes parallel shifts in the yield curve; that is, the discount rate at each maturity changes by the same amount. Portfolio duration can be calculated using effective durations of bonds with embedded options. By definition, a portfolio's internal rate of return is equal to its cash flow yield. (LOS 46.f)

4. **B** PVBP = initial price – price if yield is changed by 1 basis point.

First, we need to calculate the yield so we can calculate the price of the bond with a 1 basis point change in yield. Using a financial calculator: PV = –1,029.23; FV = 1,000; PMT = 27.5 = $(0.055 \times 1,000) / 2$; N = 14 = 2×7 years; CPT → I/Y = 2.49998, multiplied by 2 = 4.99995, or 5.00%.

Next, compute the price of the bond at a yield of 5.00% + 0.01%, or 5.01%. Using the calculator: FV = 1,000; PMT = 27.5; N = 14; I/Y = 2.505 (5.01 / 2); CPT → PV = \$1,028.63.

Finally, PVBP = \$1,029.23 – \$1,028.63 = \$0.60. (LOS 46.g)

Module Quiz 46.3

1. **B** Convexity effect = $1/2 \times \text{convexity} \times (\Delta\text{YTM})^2 = (0.5)(114.6)(0.011)^2 = 0.00693 = 0.693\%$ (LOS 46.h)
2. **C** $-7.87 \times (-1.10\%) = 8.657\%$ (LOS 46.i)
3. **B** Total estimated price change = (duration effect + convexity effect) $\{[-10.5 \times (-0.02)] + [1/2 \times 97.3 \times (-0.02)^2]\} \times 100 = 21.0\% + 1.95\% = 22.95\%$ (LOS 46.i)
4. **C** In addition to its sensitivity to changes in yield (i.e., duration), a bond's interest rate risk includes the volatility of yields. A shorter-maturity bond may have more interest rate risk than an otherwise similar longer-maturity bond if short-term yields are more volatile than long-term yields. (LOS 46.j)
5. **B** Duration gap is Macaulay duration minus the investment horizon. Because modified duration equals Macaulay duration / $(1 + \text{YTM})$, Macaulay duration is greater than modified duration for any YTM greater than zero. Therefore, this bond has a Macaulay duration greater than six years and the investment has a positive duration gap. (LOS 46.k)
6. **C** The less liquidity a bond has, the higher its yield spread relative to its benchmark. This is because investors require a higher yield to compensate them for giving up liquidity. (LOS 46.l)

The following is a review of the Fixed Income (2) principles designed to address the learning outcome statements set forth by CFA Institute. Cross-Reference to CFA Institute Assigned Reading #47.

READING 47: FUNDAMENTALS OF CREDIT ANALYSIS

Study Session 15

EXAM FOCUS

This topic review introduces credit analysis, primarily for corporate bonds, but considerations for credit analysis of high yield, sovereign, and non-sovereign government bonds are also covered. Focus on credit ratings, credit spreads, and the impact on return when ratings and spreads change.

MODULE 47.1: CREDIT RISK AND BOND RATINGS



Video covering this content is available online.

LOS 47.a: Describe credit risk and credit-related risks affecting corporate bonds.

LOS 47.b: Describe default probability and loss severity as components of credit risk.

CFA® Program Curriculum: Volume 5, page 302

Credit risk is the risk associated with losses stemming from the failure of a borrower to make timely and full payments of interest or principal. Credit risk has two components: *default risk* and *loss severity*.

- **Default risk** is the probability that a borrower (bond issuer) fails to pay interest or repay principal when due.
- **Loss severity**, or *loss given default*, refers to the value a bond investor will lose if the issuer defaults. Loss severity can be stated as a monetary amount or as a percentage of a bond's value (principal and unpaid interest).

The **expected loss** is equal to the default risk multiplied by the loss severity. Expected loss can likewise be stated as a monetary value or as a percentage of a bond's value.

The **recovery rate** is the percentage of a bond's value an investor will receive if the issuer defaults. Loss severity as a percentage is equal to one minus the recovery rate.

Bonds with credit risk trade at higher yields than bonds thought to be free of credit risk. The difference in yield between a credit-risky bond and a credit-risk-free bond of similar maturity is called its **yield spread**. For example, if a 5-year corporate bond is trading at a spread of +250 basis points to Treasuries and the yield on 5-year Treasury notes is 4.0%, the yield on the corporate bond is $4.0\% + 2.5\% = 6.5\%$.

Bond prices are inversely related to spreads; a wider spread implies a lower bond price and a narrower spread implies a higher price. The size of the spread reflects the creditworthiness of

the issuer and the liquidity of the market for its bonds. **Spread risk** is the possibility that a bond's spread will widen due to one or both of these factors.

- **Credit migration risk** or **downgrade risk** is the possibility that spreads will increase because the issuer has become less creditworthy. As we will see later in this topic review, credit rating agencies assign ratings to bonds and issuers, and may upgrade or downgrade these ratings over time.
- **Market liquidity risk** is the risk of receiving less than market value when selling a bond and is reflected in the size of the bid-ask spreads. Market liquidity risk is greater for the bonds of less creditworthy issuers and for the bonds of smaller issuers with relatively little publicly traded debt.

LOS 47.c: Describe seniority rankings of corporate debt and explain the potential violation of the priority of claims in a bankruptcy proceeding.

CFA® Program Curriculum: Volume 5, page 305

Each category of debt from the same issuer is ranked according to a **priority of claims** in the event of a default. A bond's priority of claims to the issuer's assets and cash flows is referred to as its **seniority ranking**.

Debt can be either **secured debt** or **unsecured debt**. Secured debt is backed by collateral, while unsecured debt or *debentures* represent a general claim to the issuer's assets and cash flows. Secured debt has higher priority of claims than unsecured debt.

Secured debt can be further distinguished as *first lien* or *first mortgage* (where a specific asset is pledged), *senior secured*, or *junior secured* debt. Unsecured debt is further divided into *senior*, *junior*, and *subordinated* gradations. The highest rank of unsecured debt is senior unsecured. Subordinated debt ranks below other unsecured debt.

The general seniority rankings for debt repayment priority are the following:

- First lien/senior secured.
- Second lien/secured.
- Senior unsecured.
- Senior subordinated.
- Subordinated.
- Junior subordinated.

All debt within the same category is said to rank **pari passu**, or have same priority of claims. All senior secured debt holders, for example, are treated alike in a corporate bankruptcy.

Recovery rates are highest for debt with the highest priority of claims and decrease with each lower rank of seniority. The lower the seniority ranking of a bond, the higher its credit risk. Investors require a higher yield to accept a lower seniority ranking.

In the event of a default or reorganization, senior lenders have claims on the assets before junior lenders and equity holders. A strict priority of claims, however, is not always applied in practice. Although in theory the priority of claims is absolute, in many cases lower-priority debt holders (and even equity investors) may get paid even if senior debt holders are not paid in full.

Bankruptcies can be costly and take a long time to settle. During bankruptcy proceedings, the value of a company's assets could deteriorate due to loss of customers and key employees, while legal expenses mount. A bankruptcy reorganization plan is confirmed by a vote among all classes of investors with less than 100% recovery rate. To avoid unnecessary delays, negotiation and compromise among various claimholders may result in a reorganization plan that does not strictly conform to the original priority of claims. By such a vote or by order of the bankruptcy court, the final plan may differ from absolute priority.

LOS 47.d: Distinguish between corporate issuer credit ratings and issue credit ratings and describe the rating agency practice of “notching.”

CFA® Program Curriculum: Volume 5, page 313

Credit rating agencies assign ratings to categories of bonds with similar credit risk. Rating agencies rate both the issuer (i.e., the company issuing the bonds) and the debt issues, or the bonds themselves. Issuer credit ratings are called **corporate family ratings** (CFR), while issue-specific ratings are called **corporate credit ratings** (CCR). Issuer ratings are based on the overall creditworthiness of the company. The issuers are rated on their senior unsecured debt.

[Figure 47.1](#) shows ratings scales used by Standard & Poor's, Moody's, and Fitch, three of the major credit rating agencies.

Figure 47.1: Credit Rating Categories

(a) Investment grade ratings		(b) Noninvestment grade ratings	
Moody's	Standard & Poor's, Fitch	Moody's	Standard & Poor's, Fitch
Aaa	AAA	Ba1	BB+
Aa1	AA+	Ba2	BB
Aa2	AA	Ba3	BB–
Aa3	AA–	B1	B+
A1	A+	B2	B
A2	A	B3	B–
A3	A–	Caa1	CCC+
Baa1	BBB+	Caa2	CCC
Baa2	BBB	Caa3	CCC–
Baa3	BBB–	Ca	CC
		C	C

Triple A (AAA or Aaa) is the highest rating. Bonds with ratings of Baa3/BBB– or higher are considered **investment grade**. Bonds rated Ba1/BB+ or lower are considered **noninvestment grade** and are often called *high yield bonds* or *junk bonds*.

Bonds in default are rated D by Standard & Poor's and Fitch and are included in Moody's lowest rating category, C. When a company defaults on one of its several outstanding bonds, provisions in bond indentures may trigger default on the remaining issues as well. Such a provision is called a *cross default provision*.

The ratings of a firm's individual bonds can differ from its corporate (issuer) rating. The seniority and covenants (including collateral pledged) of an individual bond issue are the primary determinants of differences between an issuer's rating and the ratings of its individual bond issues. The assignment of individual issue ratings that are higher or lower than that of the issuer is referred to as **notching**.

Another example of a factor that rating agencies consider when notching an issue credit rating is **structural subordination**. In a holding company structure, both the parent company and the subsidiaries may have outstanding debt. A subsidiary's debt covenants may restrict the transfer of cash or assets "upstream" to the parent company before the subsidiary's debt is serviced. In such a case, even though the parent company's bonds are not junior to the subsidiary's bonds, the subsidiary's bonds have a priority claim to the subsidiary's cash flows. Thus the parent company's bonds are effectively subordinated to the subsidiary's bonds.

Notching is less common for highly-rated issuers than for lower-rated issuers. For firms with high overall credit ratings, differences in expected recovery rates among a firm's individual bonds are less important, so their bonds might not be notched at all. For firms with higher probabilities of default (lower ratings), differences in expected recovery rates among a firm's bonds are more significant. For this reason, notching is more likely for issues with lower creditworthiness in general. For a firm with speculative credit, its subordinated debt might be notched two ratings below its issuer rating.

LOS 47.e: Explain risks in relying on ratings from credit rating agencies.

CFA® Program Curriculum: Volume 5, page 315

Relying on ratings from credit rating agencies has some risks. Four specific risks are:

1. **Credit ratings are dynamic.** Credit ratings change over time. Rating agencies may update their default risk assessments during the life of a bond. Higher credit ratings tend to be more stable than lower credit ratings.
2. **Rating agencies are not perfect.** Ratings mistakes occur from time to time. During a past period, subprime mortgage securities were assigned much higher ratings than they deserved.
3. **Event risk is difficult to assess.** Risks that are specific to a company or industry are difficult to predict and incorporate into credit ratings. Litigation risk to tobacco companies is one example. Events that are difficult to anticipate, such as natural

disasters, acquisitions, and equity buybacks using debt, are not easily captured in credit ratings.

4. **Credit ratings lag market pricing.** Market prices and credit spreads can change much faster than credit ratings. Additionally, two bonds with the same rating can trade at different yields. Market prices reflect expected losses, while credit ratings only assess default risk.

LOS 47.f: Explain the four Cs (Capacity, Collateral, Covenants, and Character) of traditional credit analysis.

CFA® Program Curriculum: Volume 5, page 321

A common way to categorize the key components of credit analysis is by the **four Cs of credit analysis**: capacity, collateral, covenants, and character.

Capacity

Capacity refers to a corporate borrower's ability repay its debt obligations on time. Analysis of capacity is similar to the process used in equity analysis. Capacity analysis entails three levels of assessment: (1) industry structure, (2) industry fundamentals, and (3) company fundamentals.

Industry structure

The first level of a credit analyst's assessment is industry structure. Industry structure can be described by Porter's five forces: threat of entry, power of suppliers, power of buyers, threat of substitution, and rivalry among existing competitors.



PROFESSOR'S NOTE

We describe industry analysis based on Porter's five forces in the Study Session on equity valuation.

Industry fundamentals

The next level of a credit analyst's assessment is industry fundamentals, including the influence of macroeconomic factors on an industry's growth prospects and profitability. Industry fundamentals evaluation focuses on:

- **Industry cyclicalities.** Cyclical industries are sensitive to economic performance. Cyclical industries tend to have more volatile earnings, revenues, and cash flows, which make them more risky than noncyclical industries.
- **Industry growth prospects.** Creditworthiness is most questionable for the weaker companies in a slow-growing or declining industry.
- **Industry published statistics.** Industry statistics provided by rating agencies, investment banks, industry periodicals, and government agencies can be a source for industry performance and fundamentals.

Company fundamentals

The last level of credit analysts' assessment is company fundamentals. A corporate borrower should be assessed on:

- **Competitive position.** Market share changes over time and cost structure relative to peers are some of the factors to analyze.
- **Operating history.** The performance of the company over different phases of business cycle, trends in margins and revenues, and current management's tenure.
- **Management's strategy and execution.** This includes the soundness of the strategy, the ability to execute the strategy, and the effects of management's decisions on bondholders.
- **Ratios and ratio analysis.** As we will discuss later in this topic review, leverage and coverage ratios are important tools for credit analysis.

Collateral

Collateral analysis is more important for less creditworthy companies. The market value of a company's assets can be difficult to observe directly. Issues to consider when assessing collateral values include:

- **Intangible assets.** Patents are considered high-quality intangible assets because they can be more easily sold to generate cash flows than other intangibles. Goodwill is not considered a high-quality intangible asset and is usually written down when company performance is poor.
- **Depreciation.** High depreciation expense relative to capital expenditures may signal that management is not investing sufficiently in the company. The quality of the company's assets may be poor, which may lead to reduced operating cash flow and potentially high loss severity.
- **Equity market capitalization.** A stock that trades below book value may indicate that company assets are of low quality.
- **Human and intellectual capital.** These are difficult to value, but a company may have intellectual property that can function as collateral.

Covenants

Covenants are the terms and conditions the borrowers and lenders agree to as part of a bond issue. Covenants protect lenders while leaving some operating flexibility to the borrowers to run the company. There are two types of covenants: (1) *affirmative covenants* and (2) *negative covenants*.

Affirmative covenants require the borrower to take certain actions, such as using the proceeds for the for the stated purpose; paying interest, principal, and taxes; carrying insurance on pledged assets; continuing in its current business activity; and following relevant laws and regulations. Affirmative covenants have, basically, administrative purposes.

Negative covenants restrict the borrower from taking certain actions that may reduce the value of the bondholders' claims. While affirmative covenants do not impose significant costs on the issuer (besides making the promised payments), negative covenants constrain the issuer's business activities and may thereby impose significant costs on the issuer. Examples of negative covenants include:

- Restrictions on the payment of dividends and share repurchases, for example, restricting distributions to shareholders to a certain percentage of net income.
- Restrictions on the amount of additional debt the borrower can issue, for example,

setting a maximum debt-to-equity ratio or minimum interest coverage ratio.

- Restrictions on issuing any debt with a higher priority than the subject debt issue.
- Restrictions on pledging any collateral that is currently unencumbered as collateral for new borrowing.
- Restrictions on assets sales, for example, limiting asset sales to a certain percentage of total asset value.
- Restrictions on company investment, for example, requiring that a company not invest outside its current primary business activities.
- Restrictions on mergers and acquisitions.

Covenants that are overly restrictive of an issuer's operating activities may reduce the issuer's ability to repay; for example, prohibiting asset sales that could provide the cash to pay bond interest and principal. On the other hand, covenants create a legally binding contractual framework for repayment of the debt obligation, which reduces uncertainty for the debt holders. A careful credit analysis should include an assessment of whether the covenants protect the interests of the bondholders without unduly constraining the borrower's operating activities.

Character

Character refers to management's integrity and its commitment to repay the loan. Factors such as management's business qualifications and operating record are important for evaluating character. Character analysis includes an assessment of:

- **Soundness of strategy.** Management's ability to develop a sound strategy.
- **Track record.** Management's past performance in executing its strategy and operating the company without bankruptcies, restructurings, or other distress situations that led to additional borrowing.
- **Accounting policies and tax strategies.** Use of accounting policies and tax strategies that may be hiding problems, such as revenue recognition issues, frequent restatements, and frequently changing auditors.
- **Fraud and malfeasance record.** Any record of fraud or other legal and regulatory problems.
- **Prior treatment of bondholders.** Benefits to equity holders at the expense of debt holders, through actions such as debt-financed acquisitions and special dividends, especially if they led to credit rating downgrades.



MODULE QUIZ 47.1

To best evaluate your performance, enter your quiz answers online.

1. The two components of credit risk are:
 - A. default risk and yield spread.
 - B. default risk and loss severity.
 - C. loss severity and yield spread.
2. Expected loss can decrease with an increase in a bond's:
 - A. default risk.
 - B. loss severity.
 - C. recovery rate.
3. Absolute priority of claims in a bankruptcy might be violated because:

- A. of the pari passu principle.
 - B. creditors negotiate a different outcome.
 - C. available funds must be distributed equally among creditors.
4. "Notching" is *best* described as a difference between:
- A. an issuer credit rating and an issue credit rating.
 - B. a company credit rating and an industry average credit rating.
 - C. an investment grade credit rating and a noninvestment grade credit rating.
5. Which of the following statements is *least likely* a limitation of relying on ratings from credit rating agencies?
- A. Credit ratings are dynamic.
 - B. Firm-specific risks are difficult to rate.
 - C. Credit ratings adjust quickly to changes in bond prices.
6. Ratio analysis is *most likely* used to assess a borrower's:
- A. capacity.
 - B. character.
 - C. collateral.

MODULE 47.2: EVALUATING CREDIT QUALITY



Video covering
this content is
available online.

LOS 47.g: Calculate and interpret financial ratios used in credit analysis.

LOS 47.h: Evaluate the credit quality of a corporate bond issuer and a bond of that issuer, given key financial ratios of the issuer and the industry.

CFA® Program Curriculum: Volume 5, page 325

Ratio analysis is part of capacity analysis. Two primary categories of ratios for credit analysis are *leverage ratios* and *coverage ratios*. Credit analysts calculate company ratios to assess the viability of a company, to find trends over time, and to compare companies to industry averages and peers.

Profits and Cash Flows

Profits and cash flows are needed to service debt. Here we examine four profit and cash flow metrics commonly used in ratio analysis by credit analysts.

1. **Earnings before interest, taxes, depreciation, and amortization (EBITDA).** EBITDA is a commonly used measure that is calculated as operating income plus depreciation and amortization. A drawback to using this measure for credit analysis is that it does not adjust for capital expenditures and changes in working capital, which are necessary uses of funds for a going concern. Cash needed for these uses is not available to debt holders.
2. **Funds from operations (FFO).** Funds from operations are net income from continuing operations plus depreciation, amortization, deferred taxes, and noncash items. FFO is similar to cash flow from operations (CFO) except that FFO excludes changes in working capital.
3. **Free cash flow before dividends.** Free cash flow before dividends is net income plus depreciation and amortization minus capital expenditures minus increase in working capital. Free cash flow before dividends excludes nonrecurring items.

4. **Free cash flow after dividends.** This is free cash flow before dividends minus the dividends. If free cash flow after dividends is greater than zero, it represents cash that could pay down debt or accumulate on the balance sheet. Either outcome is a form of deleveraging, a positive indicator for creditworthiness.

Leverage Ratios

Analysts should adjust debt reported on the financial statements by including the firm's obligations such as underfunded pension plans (net pension liabilities) and off-balance-sheet liabilities such as operating leases.

The most common measures of leverage used by credit analysts are the debt-to-capital ratio, the debt-to-EBITDA ratio, the FFO-to-debt ratio, and the ratio of FCF after dividends to debt.

1. **Debt/capital.** Capital is the sum of total debt and shareholders' equity. The debt-to-capital ratio is the percentage of the capital structure financed by debt. A lower ratio indicates less credit risk. If the financial statements list high values for intangible assets such as goodwill, an analyst should calculate a second debt-to-capital ratio adjusted for a writedown of these assets' after-tax value.
2. **Debt/EBITDA.** A higher ratio indicates higher leverage and higher credit risk. This ratio is more volatile for firms in cyclical industries or with high operating leverage because of their high variability of EBITDA.
3. **FFO/debt.** Because this ratio divides a cash flow measure by the value of debt, a higher ratio indicates lower credit risk.
4. **FCF after dividends/debt.** Greater values indicate a greater ability to service existing debt.

Coverage Ratios

Coverage ratios measure the borrower's ability to generate cash flows to meet interest payments. The two most commonly used are EBITDA-to-interest and EBIT-to-interest.

1. **EBITDA/interest expense.** A higher ratio indicates lower credit risk. This ratio is used more often than the EBIT-to-interest expense ratio. Because depreciation and amortization are still included as part of the cash flow measure, this ratio will be higher than the EBIT version.
2. **EBIT/interest expense.** A higher ratio indicates lower credit risk. This ratio is the more conservative measure because depreciation and amortization are subtracted from earnings.

Ratings agencies publish benchmark values for financial ratios that are associated with each ratings classification. Credit analysts can evaluate the potential for upgrades and downgrades based on subject company ratios relative to these benchmarks.

EXAMPLE: Credit analysis based on ratios

An analyst is assessing the credit quality of York, Inc. and Zale, Inc., relative to each other and their industry average. Selected financial information appears in the following table.

	York, Inc.	Zale, Inc.	Industry Average
Earnings before interest and taxes	\$550,000	\$2,250,000	\$1,400,000

Funds from operations	\$300,000	\$850,000	\$600,000
Interest expense	\$40,000	\$160,000	\$100,000
Total debt	\$1,900,000	\$2,700,000	\$2,600,000
Total capital	\$4,000,000	\$6,500,000	\$6,000,000

Explain how the analyst should evaluate the relative creditworthiness of York and Zale.

Answer:

Leverage and coverage ratios based on these data are as follows:

EBIT / interest:

York: $\$550,000 / \$40,000 = 13.8\times$

Zale: $\$2,250,000 / \$160,000 = 14.1\times$

Industry average: $\$1,400,000 / \$100,000 = 14.0\times$

Both York and Zale have interest coverage in line with their industry average.

FFO / total debt:

York: $\$300,000 / \$1,900,000 = 15.8\%$

Zale: $\$850,000 / \$2,700,000 = 31.5\%$

Industry average: $\$600,000 / \$2,600,000 = 23.1\%$

Zale's funds from operations relative to its debt level are greater than the industry average, while York is generating less FFO relative to its debt level.

Total debt / total capital:

York: $\$1,900,000 / \$4,000,000 = 47.5\%$

Zale: $\$2,700,000 / \$6,500,000 = 41.5\%$

Industry average: $\$2,600,000 / \$6,000,000 = 43.3\%$

York is more leveraged than Zale and the industry average. Based on these data, Zale appears to be more creditworthy than York.

LOS 47.i: Describe factors that influence the level and volatility of yield spreads.

CFA® Program Curriculum: Volume 5, page 338

We can think of the yield on an option-free corporate bond as the sum of the real risk-free interest rate, the expected inflation rate, a maturity premium, a liquidity premium, and a credit spread. All bond prices and yields are affected by changes in the first three of these components. The last two components are the yield spread:

$$\text{yield spread} = \text{liquidity premium} + \text{credit spread}$$

Yield spreads on corporate bonds are affected primarily by five interrelated factors:

1. **Credit cycle.** The market's perception of overall credit risk is cyclical. At the top of the credit cycle, the bond market perceives low credit risk and is generally bullish. Credit

spreads narrow as the credit cycle improves. Credit spreads widen as the credit cycle deteriorates.

2. **Economic conditions.** Credit spreads narrow as the economy strengthens and investors expect firms' credit metrics to improve. Conversely, credit spreads widen as the economy weakens.
3. **Financial market performance.** Credit spreads narrow in strong-performing markets overall, including the equity market. Credit spreads widen in weak-performing markets. In steady-performing markets with low volatility of returns, credit spreads also tend to narrow as investors reach for yield.
4. **Broker-dealer capital.** Because most bonds trade over the counter, investors need broker-dealers to provide market-making capital for bond markets to function. Yield spreads are narrower when broker-dealers provide sufficient capital but can widen when market-making capital becomes scarce.
5. **General market demand and supply.** Credit spreads narrow in times of high demand for bonds. Credit spreads widen in times of low demand for bonds. Excess supply conditions, such as large issuance in a short period of time, can lead to widening spreads.

Yield spreads on lower-quality issues tend to be more volatile than spreads on higher-quality issues.

LOS 47.j: Explain special considerations when evaluating the credit of high yield, sovereign, and non-sovereign government debt issuers and issues.

CFA® Program Curriculum: Volume 5, page 347

High Yield Debt

High yield or *noninvestment grade* corporate bonds are rated below Baa3/BBB by credit rating agencies. These bonds are also called *junk bonds* because of their higher perceived credit risk.

Reasons for noninvestment grade ratings may include:

- High leverage.
- Unproven operating history.
- Low or negative free cash flow.
- High sensitivity to business cycles.
- Low confidence in management.
- Unclear competitive advantages.
- Large off-balance-sheet liabilities.
- Industry in decline.

Because high yield bonds have higher default risk than investment grade bonds, credit analysts must pay more attention to loss severity. Special considerations for high yield bonds include their liquidity, financial projections, debt structure, corporate structure, and covenants.

Liquidity. Liquidity or availability of cash is critical for high yield issuers. High yield issuers have limited access to additional borrowings, and available funds tend to be more expensive for high yield issuers. Bad company-specific news and difficult financial market conditions can quickly dry up the liquidity of debt markets. Many high yield issuers are privately owned and cannot access public equity markets for needed funds.

Analysts focus on six sources of liquidity (in order of reliability):

1. Balance sheet cash.
2. Working capital.
3. Operating cash flow (CFO).
4. Bank credit.
5. Equity issued.
6. Sales of assets.

For a high yield issuer with few or unreliable sources of liquidity, significant amounts of debt coming due within a short time frame may indicate potential default. Running out of cash with no access to external financing to refinance or service existing debt is the primary reason why high yield issuers default. For high yield financial firms that are highly levered and depend on funding long-term assets with short-term liabilities, liquidity is critical.

Financial projections. Projecting future earnings and cash flows, including stress scenarios and accounting for changes in capital expenditures and working capital, are important for revealing potential vulnerabilities to the inability to meet debt payments.

Debt structure. High yield issuers' capital structures often include different types of debt with several levels of seniority and hence varying levels of potential loss severity. Capital structures typically include secured bank debt, second lien debt, senior unsecured debt, subordinated debt, and preferred stock. Some of these, especially subordinated debt, may be convertible to common shares.

A credit analyst will need to calculate leverage for each level of the debt structure when an issuer has multiple layers of debt with a variety of expected recovery rates.

High yield companies for which secured bank debt is a high proportion of the capital structure are said to be *top heavy* and have less capacity to borrow from banks in financially stressful periods. Companies that have top-heavy capital structures are more likely to default and have lower recovery rates for unsecured debt issues.

Corporate structure. Many high-yield companies use a holding company structure. A parent company receives dividends from the earnings of subsidiaries as its primary source of operating income. Because of structural subordination, subsidiaries' dividends paid upstream to a parent company are subordinate to interest payments. These dividends can be insufficient to pay the debt obligations of the parent, thus reducing the recovery rate for debt holders of the parent company.

Despite structural subordination, a parent company's credit rating may be superior to subsidiaries' ratings because the parent can benefit from having access to multiple cash flows from diverse subsidiaries.

Some complex corporate structures have intermediate holding companies that carry their own debt and do not own 100% of their subsidiaries' stock. These companies are typically a result

of mergers, acquisitions, or leveraged buyouts.

Default of one subsidiary may not necessarily result in cross default. Analysts need to scrutinize bonds' indentures and other legal documents to fully understand the impact of complex corporate structures. To analyze these companies, analysts should calculate leverage ratios at each level of debt issuance and on a consolidated basis.

Covenants. Important covenants for high yield debt include:

- **Change of control put.** This covenant gives debt holders the right to require the issuer to buy back debt (typically for par value or a value slightly above par) in the event of an acquisition. For investment grade bonds, a change of control put typically applies only if an acquisition of the borrower results in a rating downgrade to below investment grade.
- **Restricted payments.** The covenant protects lenders by limiting the amount of cash that may be paid to equity holders.
- **Limitations on liens.** The covenant limits the amount of secured debt that a borrower can carry. Unsecured debt holders prefer the issuer to have less secured debt, which increases the recovery amount available to them in the event of default.
- **Restricted versus unrestricted subsidiaries.** Issuers can classify subsidiaries as restricted or unrestricted. Restricted subsidiaries' cash flows and assets can be used to service the debt of the parent holding company. This benefits creditors of holding companies because their debt is *pari passu* with the debt of restricted subsidiaries, rather than structurally subordinated. Restricted subsidiaries are typically the holding company's larger subsidiaries that have significant assets. Tax and regulatory issues can factor into the classification of subsidiary's restriction status. A subsidiary's restriction status is found in the bond indenture.

Bank covenants are often more restrictive than bond covenants, and when covenants are violated, banks can block additional loans until the violation is corrected. If a violation is not remedied, banks can trigger a default by accelerating the full repayment of a loan.

In terms of the factors that affect their return, high yield bonds may be viewed as a hybrid of investment grade bonds and equity. Compared to investment grade bonds, high yield bonds show greater price and spread volatility and are more highly correlated with the equity market.

High yield analysis can include some of the same techniques as equity market analysis, such as enterprise value. **Enterprise value (EV)** is equity market capitalization plus total debt minus excess cash. For high yield companies that are not publicly traded, comparable public company equity data can be used to estimate EV. Enterprise value analysis can indicate a firm's potential for additional leverage, or the potential credit damage that might result from a leveraged buyout. An analyst can compare firms based on the differences between their EV/EBITDA and debt/EBITDA ratios. Firms with a wider difference between these ratios have greater equity relative to their debt and therefore have less credit risk.

Sovereign Debt

Sovereign debt is issued by national governments. Sovereign credit analysis must assess both the government's ability to service debt and its willingness to do so. The assessment of

willingness is important because bondholders usually have no legal recourse if a national government refuses to pay its debts.

A basic framework for evaluating and assigning a credit rating to sovereign debt includes five key areas:

1. **Institutional assessment** includes successful policymaking, minimal corruption, checks and balances among institutions, and a culture of honoring debts.
2. **Economic assessment** includes growth trends, income per capita, and diversity of sources for economic growth.
3. **External assessment** includes the country's foreign reserves, its external debt, and the status of its currency in international markets.
4. **Fiscal assessment** includes the government's willingness and ability to increase revenue or cut expenditures to ensure debt service, as well as trends in debt as a percentage of GDP.
5. **Monetary assessment** includes the ability to use monetary policy for domestic economic objectives (this might be lacking with exchange rate targeting or membership in a monetary union) and the credibility and effectiveness of monetary policy.

Credit rating agencies assign each national government two ratings: (1) a local currency debt rating and (2) a foreign currency debt rating. The ratings are assigned separately because defaults on foreign currency denominated debt have historically exceeded those on local currency debt. Foreign currency debt typically has a higher default rate and a lower credit rating because the government must purchase foreign currency in the open market to make interest and principal payments, which exposes it to the risk of significant local currency depreciation. In contrast, local currency debt can be repaid by raising taxes, controlling domestic spending, or simply printing more money. Ratings can differ as much as two notches for local and foreign currency bonds.

Sovereign defaults can be caused by events such as war, political instability, severe devaluation of the currency, or large declines in the prices of the country's export commodities. Access to debt markets can be difficult for sovereigns in bad economic times.

Non-Sovereign Government Bonds

Non-sovereign government debt is issued by local governments (cities, states, and counties) and quasi-governmental entities. **Municipal bonds** are a significant part of the overall U.S. bond market. Interest payments from municipal bonds are most often exempt from national income taxes. Default rates for municipal bonds are very low relative to general corporate bonds.

Most municipal bonds can be classified as *general obligation bonds* or *revenue bonds*.

General obligation (GO) bonds are unsecured bonds backed by the full faith credit of the issuing governmental entity, which is to say they are supported by its taxing power. **Revenue bonds** are issued to finance specific projects, such as airports, toll bridges, hospitals, and power generation facilities.

Unlike sovereigns, municipalities cannot use monetary policy to service their debt and usually must balance their operating budgets. Municipal governments' ability to service their general obligation debt depends ultimately on the local economy (i.e., the tax base). Economic factors to assess in evaluating the creditworthiness of GO bonds include

employment, trends in per capita income and per capita debt, tax base dimensions (depth, breadth, and stability), demographics, and ability to attract new jobs (location, infrastructure). Credit analysts must also observe revenue variability through economic cycles. Relying on highly variable taxes that are subject to economic cycles, such as capital gains and sales taxes, can signal higher credit risk. Municipalities may have long-term obligations such as underfunded pensions and post-retirement benefits. Inconsistent reporting requirements for municipalities are also an issue.

Revenue bonds often have higher credit risk than GO bonds because the project is the sole source of funds to service the debt. Analysis of revenue bonds combines analysis of the project, using techniques similar to those for analyzing corporate bonds, with analysis of the financing of the project.



MODULE QUIZ 47.2

To best evaluate your performance, enter your quiz answers online.

1. Higher credit risk is indicated by a higher:
 - A. FFO/debt ratio.
 - B. debt/EBITDA ratio.
 - C. EBITDA/interest expense ratio.
2. Compared to other firms in the same industry, an issuer with a credit rating of AAA should have a lower:
 - A. FFO/debt ratio.
 - B. operating margin.
 - C. debt/capital ratio.
3. Credit spreads tend to widen as:
 - A. the credit cycle improves.
 - B. economic conditions worsen.
 - C. broker-dealers become more willing to provide capital.
4. Compared to shorter duration bonds, longer duration bonds:
 - A. have smaller bid-ask spreads.
 - B. are less sensitive to credit spreads.
 - C. have less certainty regarding future creditworthiness.
5. One key difference between sovereign bonds and municipal bonds is that sovereign issuers:
 - A. can print money.
 - B. have governmental taxing power.
 - C. are affected by economic conditions.

KEY CONCEPTS

LOS 47.a

Credit risk refers to the possibility that a borrower fails to make the scheduled interest payments or return of principal.

Spread risk is the possibility that a bond loses value because its credit spread widens relative to its benchmark. Spread risk includes credit migration or downgrade risk and market liquidity risk.

LOS 47.b

Credit risk is composed of default risk, which is the probability of default, and loss severity, which is the portion of the value of a bond or loan a lender or investor will lose if the borrower defaults. The expected loss is the probability of default multiplied by the loss severity.

LOS 47.c

Corporate debt is ranked by seniority or priority of claims. Secured debt is a direct claim on specific firm assets and has priority over unsecured debt. Secured or unsecured debt may be further ranked as senior or subordinated. Priority of claims may be summarized as follows:

- First lien/senior secured.
- Second lien/secured.
- Senior unsecured.
- Senior subordinated.
- Subordinated.
- Junior subordinated.

LOS 47.d

Issuer credit ratings, or corporate family ratings, reflect a debt issuer's overall creditworthiness and typically apply to a firm's senior unsecured debt.

Issue credit ratings, or corporate credit ratings, reflect the credit risk of a specific debt issue. Notching refers to the practice of adjusting an issue credit rating upward or downward from the issuer credit rating to reflect the seniority, covenants, and possibly the expected recovery in the event of a default of a debt issue.

LOS 47.e

Lenders and bond investors should not rely exclusively on credit ratings from rating agencies for the following reasons:

- Credit ratings can change during the life of a debt issue.
- Rating agencies cannot always judge credit risk accurately.
- Firms are subject to risk of unforeseen events that credit ratings do not reflect.
- Market prices of bonds often adjust more rapidly than credit ratings.

LOS 47.f

Components of traditional credit analysis are known as the four Cs:

- Capacity: The borrower's ability to make timely payments on its debt.
- Collateral: The value of assets pledged against a debt issue or available to creditors if the issuer defaults.
- Covenants: Provisions of a bond issue that protect creditors by requiring or prohibiting actions by an issuer's management.
- Character: Assessment of an issuer's management, strategy, quality of earnings, and past treatment of bondholders.

LOS 47.g

Credit analysts use profitability, cash flow, and leverage and coverage ratios to assess debt issuers' capacity.

- Profitability refers to operating income and operating profit margin, with operating income typically defined as earnings before interest and taxes (EBIT).
- Cash flow may be measured as earnings before interest, taxes, depreciation, and amortization (EBITDA); funds from operations (FFO); free cash flow before dividends; or free cash flow after dividends.
- Leverage ratios include debt-to-capital, debt-to-EBITDA, and FFO-to-debt.
- Coverage ratios include EBIT-to-interest expense and EBITDA-to-interest expense.

LOS 47.h

Lower leverage, higher interest coverage, and greater free cash flow imply lower credit risk and a higher credit rating for a firm. When calculating leverage ratios, analysts should include in a firm's total debt its obligations such as underfunded pensions and off-balance-sheet financing.

For a specific debt issue, secured collateral implies lower credit risk compared to unsecured debt, and higher seniority implies lower credit risk compared to lower seniority.

LOS 47.i

Corporate bond yields comprise the real risk-free rate, expected inflation rate, credit spread, maturity premium, and liquidity premium. An issue's yield spread to its benchmark includes its credit spread and liquidity premium.

The level and volatility of yield spreads are affected by the credit and business cycles, the performance of financial markets as a whole, availability of capital from broker-dealers, and supply and demand for debt issues. Yield spreads tend to narrow when the credit cycle is improving, the economy is expanding, and financial markets and investor demand for new debt issues are strong. Yield spreads tend to widen when the credit cycle, the economy, and financial markets are weakening, and in periods when the supply of new debt issues is heavy or broker-dealer capital is insufficient for market making.

LOS 47.j

High yield bonds are more likely to default than investment grade bonds, which increases the importance of estimating loss severity. Analysis of high yield debt should focus on liquidity, projected financial performance, the issuer's corporate and debt structures, and debt covenants.

Credit risk of sovereign debt includes the issuing country's ability and willingness to pay. Ability to pay is greater for debt issued in the country's own currency than for debt issued in

a foreign currency. Willingness refers to the possibility that a country refuses to repay its debts.

Analysis of non-sovereign government debt is similar to analysis of sovereign debt, focusing on the strength of the local economy and its effect on tax revenues. Analysis of municipal revenue bonds is similar to analysis of corporate debt, focusing on the ability of a project to generate sufficient revenue to service the bonds.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 47.1

1. **B** Credit risk is composed of default risk and loss severity. Yield spreads reflect the credit risk of a borrower. (LOS 47.a)
2. **C** An increase in the recovery rate means that the loss severity has decreased, which decreases expected loss. (LOS 47.b)
3. **B** A negotiated bankruptcy settlement does not always follow the absolute priority of claims. (LOS 47.c)
4. **A** Notching refers to the credit rating agency practice of distinguishing between the credit rating of an issuer (generally for its senior unsecured debt) and the credit rating of particular debt issues from that issuer, which may differ from the issuer rating because of provisions such as seniority. (LOS 47.d)
5. **C** Bond prices and credit spreads change much faster than credit ratings. (LOS 47.e)
6. **A** Ratio analysis is used to assess a corporate borrower's capacity to repay its debt obligations on time. (LOS 47.f)

Module Quiz 47.2

1. **B** A higher debt/EBITDA ratio is sign of higher leverage and higher credit risk. Higher FFO/debt and EBITDA/interest expense ratios indicate lower credit risk. (LOS 47.g, 47.h)
2. **C** A low debt/capital ratio is an indicator of low leverage. An issuer rated AAA is likely to have a high operating margin and a high FFO/debt ratio compared to its industry group. (LOS 47.g, 47.h)
3. **B** Credit spreads widen as economic conditions worsen. Spreads narrow as the credit cycle improves and as broker-dealers provide more capital to bond markets. (LOS 47.i)
4. **C** Longer duration bonds usually have longer maturities and carry more uncertainty of future creditworthiness. (LOS 47.i)
5. **A** Sovereign entities can print money to repay debt, while municipal borrowers cannot. Both sovereign and municipal entities have taxing powers, and both are affected by economic conditions. (LOS 47.j)

TOPIC ASSESSMENT: FIXED INCOME

You have now finished the Fixed Income topic section. The following Topic Assessment provides immediate feedback on how effective your study has been for this material. The number of questions on this test is equal to the number of questions for the topic on one-half of the actual Level I CFA exam. Questions are more exam-like than typical Module Quiz or QBank questions; a score of less than 70% indicates that your study likely needs improvement. These tests are best taken timed; allow 1.5 minutes per question.

After you've completed this Topic Assessment, you may additionally log in to your [Schweser.com](https://www.schweser.com) online account and enter your answers in the Topic Assessments product. Select "Performance Tracker" to view a breakdown of your score. Select "Compare with Others" to display how your score on the Topic Assessment compares to the scores of others who entered their answers.

1. An estimate of the increase in an option-free bond's price, based only on its duration:
 - A. will be too small.
 - B. will be too large.
 - C. may be either too small or too large.
2. Three companies in the same industry have exhibited the following average ratios over a 5-year period:

5-Year Averages	Alden	Barrow	Collison
Operating margin	13.3%	15.0%	20.7%
Debt/EBITDA	4.6×	0.9×	2.8×
EBIT/interest	3.6×	8.9×	5.7×
FFO/debt	12.5%	14.6%	11.5%
Debt/capital	60.8%	23.6%	29.6%

Based only on the information given, the company that *most likely* has the highest credit rating is:

- A. Alden.
 - B. Barrow.
 - C. Collison.
3. The difference between a convertible bond and a bond with warrants is that a bondholder who exercises warrants:
 - A. does not pay cash for the common stock.
 - B. obtains common stock at a lower price per share.
 - C. continues to hold the bond after exercising the warrants.
 4. Which of the following is *least likely* a common form of external credit enhancement?
 - A. Overcollateralization.

- B. A corporate guarantee.
 - C. A letter of credit from a bank.
5. Nonconforming mortgage loans may be securitized by:
 - A. government-sponsored enterprises, but not by private companies.
 - B. private companies, but not by government-sponsored enterprises.
 - C. neither private companies nor government-sponsored enterprises.
 6. Which of the following bonds would appreciate the *most* if the yield curve shifts down by 50 basis points at all maturities?
 - A. 4-year 8%, 8% YTM.
 - B. 5-year 8%, 7.5% YTM.
 - C. 5-year 8.5%, 8% YTM.
 7. Which of the following provisions would *most likely* increase the required yield to maturity on a debt security?
 - A. Call option.
 - B. Put option.
 - C. Floor on a floating-rate security.
 8. Other things equal, a corporate bond's yield spread is likely to be *most* volatile if the bond is rated:
 - A. AA with 5 years to maturity.
 - B. AAA with 3 years to maturity.
 - C. BBB with 15 years to maturity.
 9. In a repurchase agreement, the repo rate is likely to be higher:
 - A. if delivery to the lender is required.
 - B. when the quality of the collateral is high.
 - C. for longer-dated repos.
 10. An investor in longer-term coupon bonds who has a short investment horizon is *most likely*:
 - A. more concerned with market price risk than reinvestment risk.
 - B. more concerned with reinvestment risk than market price risk.
 - C. equally concerned about market price risk and reinvestment risk.
 11. A bank loan department is trying to determine the correct rate for a 2-year loan to be made two years from now. If current implied Treasury effective annual spot rates are 1-year = 2%, 2-year = 3%, 3-year = 3.5%, and 4-year = 4.5%, the base (risk-free) forward rate for the loan before adding a risk premium is *closest* to:
 - A. 4.5%.
 - B. 6.0%.
 - C. 9.0%.
 12. Coyote Corporation has an issuer credit rating of AA, but its most recently issued bonds have an issue credit rating of AA-. This difference is *most likely* due to the newly issued bonds having:
 - A. been issued as senior subordinated debt.
 - B. been affected by restricted subsidiary status.
 - C. additional covenants that protect the bondholders.

13. An institution is *most likely* to be restricted from investing in which of the following fixed income classifications?
- A. High yield.
 - B. Index-linked.
 - C. Floating-rate.
14. Annual-pay yields of annual-coupon sovereign bonds are as follows:

<u>Maturity and Coupon</u>	<u>Yield to Maturity</u>
1-year, 5% coupon	2.342%
1-year, 0% coupon	2.350%
2-year, 5% coupon	2.496%
2-year, 0% coupon	2.500%
3-year, 5% coupon	2.711%
3-year, 0% coupon	2.725%

- The 3-year, 5% annual coupon bond is *most likely*:
- A. overvalued.
 - B. undervalued.
 - C. fairly valued.

TOPIC ASSESSMENT ANSWERS: FIXED INCOME

1. **A** Duration is a linear measure, but the relationship between bond price and yield for an option-free bond is convex. For a given decrease in yield, the estimated price increase using duration alone will be smaller than the actual price increase. (Study Session 15, Module 46.1, LOS 46.b)
2. **B** Four of the five credit metrics given indicate that Barrow should have the highest credit rating of these three companies. Barrow has higher interest coverage and lower leverage than either Alden or Collison. (Study Session 15, Module 47.2, LOS 47.h)
3. **C** Warrants give holders the option to buy shares of the issuer's common stock at a predetermined price. A bondholder who exercises warrants pays the exercise price to the issuer and receives common shares but continues to hold the bond. With convertible bonds, a bondholder who exercises the conversion option exchanges the bond for a predetermined number of common shares. Exercise prices of warrants and conversion prices of convertible bonds are not necessarily related. (Study Session 14, Module 42.2, LOS 42.f)
4. **A** External credit enhancements are financial guarantees from third parties that generally support the performance of the bond. Overcollateralization is a form of internal credit enhancement. (Study Session 14, Module 42.1, LOS 42.d)
5. **B** Nonconforming mortgages are those that do not meet the requirements to be included in agency RMBS such as those issued by government-sponsored enterprises. Private companies may securitize nonconforming mortgages. (Study Session 14, Module 45.1, LOS 45.d)
6. **B** The bond with the highest duration will benefit the most from a decrease in rates. The lower the coupon, the lower the yield to maturity, and the longer the time to maturity, then the higher the duration will be. (Study Session 15, Module 46.2, LOS 46.e)
7. **A** Call options favor the issuer and increase the required YTM. A put option or a floor protects the bondholder against falling rates, which reduces a bond's required YTM. (Study Session 14, Module 42.2, LOS 42.f)
8. **C** Spread volatility is typically greatest for lower quality and longer maturities. The BBB rated 15-year corporate bond has the lowest credit quality and longest maturity of the three choices. (Study Session 15, Module 47.2, LOS 47.i)
9. **C** The repo rate tends to be higher for longer-dated repos than for shorter-dated repos. High quality collateral or delivery of the collateral reduces the repo rate. (Study Session 14, Module 43.2, LOS 43.j)
10. **A** Over a short investment horizon, an increase in interest rates is likely to decrease the return on a coupon bond because the decrease in price more than offsets the increase in reinvestment income. Over a long investment horizon, a decrease in interest rates is likely to decrease the return on a coupon bond because the decrease in reinvestment income more than offsets the increase in price. Therefore, an investor with a short horizon is more concerned with market price risk and an investor with a

long horizon is more concerned with reinvestment risk. (Study Session 15, Module 46.3, LOS 46.k)

11. **B** The forward rate is $[1.045^4 / 1.03^2]^{1/2} - 1 = 6.02\%$, or use the approximation $[4.5(4) - 3(2)] / 2 = 6$. (Study Session 14, Module 44.4, LOS 44.j)
12. **A** The issuer's corporate family rating (CFR) is AA, while the bond's corporate credit rating (CCR) is lower, AA-. One possible reason for this notching difference is that the bond may have a lower seniority ranking. CFR ratings are based on senior unsecured debt. If the newly issued bond is a senior subordinated debt, it has a lower priority of claims and hence a lower rating. Restricted status would affect both CFR and CCR. Additional covenants that protect bondholders would enhance the issue's CCR. (Study Session 15, Module 47.1, LOS 47.d)
13. **A** High yield bonds are those that are classified as noninvestment grade. Some institutions are restricted from investing in this sector of the fixed income market. (Study Session 14, Module 43.1, LOS 43.a)
14. **C** The price of the 3-year coupon bond (as a percentage of par) is: $N = 3$; $I/Y = 2.711$; $PMT = 5$; $FV = 100$; $CPT \rightarrow PV = -106.51$

The no-arbitrage price of the 3-year coupon bond based on spot (zero-coupon) rates is:

$$\frac{5}{1.02350} + \frac{5}{(1.02500)^2} + \frac{105}{(1.02725)^3} = 106.51$$

Because the 3-year coupon bond's price equals its no-arbitrage value, the bond is fairly valued. (Study Session 14, Modules 44.1, 44.2, LOS 44.a, 44.c)

APPENDIX

Rates, Returns, and Yields

A **holding period return** (HPR), or holding period yield (HPY), can be for a period of any length and is simply the percentage increase in value over the period, which is calculated as:

$$\text{HPR} = \text{ending value} / \text{beginning value} - 1$$

1. If an investor puts \$2,000 into an account and 565 days later it has grown in value to \$2,700, the 565-day HPY is $2,700 / 2,000 - 1 = 35\%$.
2. If an investor buys a share of stock for \$20/share, receives a \$0.40 dividend, and sells the shares after nine months, the nine-month HPY is $(22 + 0.40) / 20 - 1 = 12\%$.

An HPR for a given period is also the **effective yield** for that period.

An **effective annual yield** is the HPR for a one-year investment or the HPY for a different period converted to its annual equivalent yield.

3. If the six-month HPR is 2%, the effective annual yield is $1.02^2 - 1 = 4.040\%$.
4. If the 125-day HPR is 1.5%, the effective annual yield is $1.015^{365/125} - 1 = 4.443\%$.
5. If the two-year HPR (two-year effective rate) is 9%, the effective annual yield is $1.09^{1/2} - 1 = 4.4031\%$.

Compounding Frequency

Sometimes the “rate” on an investment is expressed as a **simple annual rate** (or *stated rate*)—the annual rate with no compounding of returns. The number of compounding periods per year is called the **periodicity** of the rate. For a periodicity of one, the stated rate and the effective annual rate are the same. When the periodicity is greater than one (more than one compounding period per year), the effective annual rate is the effective rate for the sub-periods, compounded for the number of sub-periods.

6. A bank CD has a stated annual rate of 6% with annual compounding (periodicity of 1); the effective annual rate is 6% and a \$1,000 investment will return $\$1,000(1.06) = \$1,060$ at the end of one year.
7. A bank CD has a stated annual rate of 6% with semiannual compounding (periodicity of 2); the effective annual rate is $(1 + 0.06 / 2)^2 - 1 = 6.09\%$ and a \$1,000 investment will return $\$1,000 (1.0609) = \$1,060.90$ at the end of one year.
8. A bank CD has a stated annual rate of 6% with quarterly compounding (periodicity of 4); the effective annual rate is $(1 + 0.06 / 4)^4 - 1 = 6.136\%$ and a \$1,000 investment will return $\$1,000(1.06136) = \$1,061.36$ at the end of one year.

Note that increasing compounding frequency increases the effective annual yield for any given stated rate. In the limit, as compounding periods get shorter (more frequent), compounding is *continuous*. A stated rate of $r\%$, with continuous compounding, results in an effective annual return of $e^r - 1$.

9. A bank CD has a stated annual rate of 6%, continuously compounded; its effective annual yield is $e^{0.06} - 1 = 6.184\%$ and a \$1,000 investment will return \$1,061.84 at the end of one year.

Bond Quotations and Terminology

The **stated (coupon) rate** on a bond is the total cash coupon payments made over one year as a percentage of face value.

10. A bond with a face value of \$1,000 that pays a coupon of \$50 once each year (an annual-pay bond) has a stated (coupon) rate of $50 / 1,000 = 5\%$ and we say it has a periodicity of 1.

11. A bond with a face value of \$1,000 that pays a coupon of \$25 twice each year (a semiannual-pay bond) has a stated (coupon) rate of $(25 + 25) / 1,000 = 5\%$ and we say it has a periodicity of 2.

12. A bond with a face value of \$1,000 that pays a coupon of \$12.50 (1.25%) four times each year (a quarterly-pay bond) has a coupon rate of $(12.50 + 12.50 + 12.50 + 12.50) / 1,000 = 5\%$ and we say it has a periodicity of 4.

The **current yield** on a bond is the stated (coupon) rate divided by the bond price as a percentage of face value or, alternatively, the sum of the coupon payments for one year divided by the bond price.

13. A bond with a stated coupon rate of 5% that is selling at 98.54% of face value has a current yield of $5 / 98.54 = 5.074\%$.

14. A bond that is trading at \$1,058 and makes annual coupon payments that sum to \$50 has a current yield of $50 / 1,058 = 4.726\%$.

The **yield to maturity (YTM)** of a bond, on an *annual basis*, is the effective annual yield and is used for bonds that pay an annual coupon. For bonds that pay coupons semiannually, we often quote the YTM on a *semiannual basis*, that is, two times the effective semiannual yield. To compare the yields of two bonds, we must calculate their YTM's on the same basis.

15. A bond with a YTM of 5% on a semiannual basis has a YTM on an annual basis (effective annual yield) of $(1 + 0.05 / 2)^2 - 1 = 5.0625\%$.

16. A bond with a YTM of 5% on an annual basis has a YTM on a semiannual basis of $(1.05^{1/2} - 1) \times 2 = 4.939\%$.

Internal Rate of Return (IRR)

The internal rate of return is the discount rate that makes the PV of a series of cash flows equal to zero. This calculation must be done with a financial calculator. We use the IRR for calculating the return on a capital project, the YTM on a bond, and the money weighted rate of return for a portfolio.

17. For the YTM of an annual-pay bond (YTM on an annual basis) on a coupon date with N years remaining until maturity, we calculate the annual IRR that satisfies:

$$-\text{bond price} + \frac{\text{coupon 1}}{1+\text{IRR}} + \frac{\text{coupon 2}}{(1+\text{IRR})^2} + \dots + \frac{\text{coupon } N + \text{face value}}{(1+\text{IRR})^N} = 0$$

18. For the YTM of a semiannual-pay bond on a coupon date with N years remaining until maturity, we calculate the IRR that satisfies:

$$-\text{bond price} + \frac{\text{coupon 1}}{1 + \frac{\text{IRR}}{2}} + \frac{\text{coupon 2}}{\left(1 + \frac{\text{IRR}}{2}\right)^2} + \dots + \frac{\text{coupon } 2N + \text{face value}}{\left(1 + \frac{\text{IRR}}{2}\right)^{2N}} = 0$$

After solving for $\text{IRR} / 2$, which is the IRR for semiannual periods, we must multiply it by 2 to get the bond's YTM on a semiannual basis.

19. For a capital project, the (annual) IRR satisfies:

$$-\text{initial outlay} + \frac{\text{CF}_1}{1 + \text{IRR}} + \frac{\text{CF}_2}{(1 + \text{IRR})^2} + \dots + \frac{\text{CF}_N}{(1 + \text{IRR})^N} = 0$$

where annual cash flows (CF) can be positive or negative (when a future expenditure is required). Note that if the sign of the cash flows changes more than once, there may be more than one IRR that satisfies the equation.

Money Market Securities

For some money market securities, such as U.S. T-bills, price quotations are given on a bond discount (or simply discount) basis. The bond discount yield (BDY) is the percentage discount from face value of a T-bill, annualized based on a 360-day year, and is therefore not an effective yield but simply an annualized discount from face value.

20. A T-bill that will pay \$1,000 at maturity in 180 days is selling for \$984, a discount of $1 - 984 / 1,000 = 1.6\%$. The annualized discount is $1.6\% \times 360 / 180 = 3.2\%$.

21. A 120-day T-bill is quoted at a BDY of 2.83%, its price is $[1 - (0.0283 \times 120 / 360)] \times 1,000 = \990.57 . Its 120-day *holding period return* is $1,000 / 990.57 - 1 = 0.952\%$. Its *effective annual yield* is $(1,000 / 990.57)^{365/120} - 1 = 2.924\%$.

LIBOR (London Interbank Offered Rate) is an add-on rate quoted for several currencies and for several periods of one year or less, as an annualized rate.

22. HPY on a 30-day loan at a quoted LIBOR rate of 1.8% is $0.018 \times 30 / 360 = 0.15\%$ so the interest on a \$10,000 loan is $10,000 \times 0.0015 = \$15$.

A related yield is the **money market yield** (MMY), which is HPY annualized based on a 360-day year.

23. A 120-day discount security with a maturity value of \$1,000 that is priced at \$995 has a money market yield of $(1,000 / 995 - 1) \times 360 / 120 = 1.5075\%$.

Forward rates are rates for a loan to be made in a future period. They are quoted based on the period of the loan. For loans of one year, we write 1y1y for a 1-year loan to be made one year from today and 2y1y for a 1-year loan to be made two years from today.

Spot rates are discount rates for single payments to be made in the future (such as for zero-coupon bonds).

24. Given a 3-year spot rate expressed as a compound annual rate (S_3) of 2%, a 3-year bond that makes a single payment of \$1,000 in three years has a current value of $1,000 / (1 + 0.02)^3 = \$942.32$.

An N -year spot rate is the geometric mean of the individual annual forward rates:

$$S_N = [(1 + S_1)(1 + 1y1y)(1 + 2y1y) \dots (1 + Ny1y)]^{1/N} - 1$$

and the annualized forward rate for $M - N$ periods, N periods from now is:

$$Ny(M - N)y = \left[\frac{(1 + S_M)^M}{(1 + S_N)^N} \right]^{\frac{1}{M - N}} - 1$$

25. Given $S_5 = 2.4\%$ and $S_7 = 2.6\%$, $5y2y = [(1.026)^7 / (1.024)^5]^{1/2} - 1 = 3.1017\%$, which is approximately equal to $(7 \times 2.6\% - 5 \times 2.4\%) / 2 = 3.1\%$.

FORMULAS

$$NPV = CF_0 + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \dots + \frac{CF_n}{(1+k)^n} = \sum_{t=0}^n \frac{CF_t}{(1+k)^t}$$

$$IRR: 0 = CF_0 + \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \dots + \frac{CF_n}{(1+IRR)^n} = \sum_{t=0}^n \frac{CF_t}{(1+IRR)^t}$$

$$\text{payback period} = \text{full years until recovery} + \frac{\text{unrecovered cost at the beginning of the last year}}{\text{cash flow during the last year}}$$

$$PI = \frac{\text{PV of future cash flows}}{CF_0} = 1 + \frac{NPV}{CF_0}$$

$$WACC = (w_d)[k_d (1 - t)] + (w_{ps})(k_{ps}) + (w_{ce})(k_{ce})$$

$$\text{after-tax cost of debt} = k_d (1 - t)$$

$$\text{cost of preferred stock} = k_{ps} = D_{ps} / P$$

cost of common equity:

$$k_{ce} = \frac{D_1}{P_0} + g$$

$$k_{ce} = R_f + \beta[E(R_m) - R_f]$$

$$k_{ce} = \text{bond yield} + \text{risk premium}$$

unlevered asset beta:

$$\beta_{\text{ASSET}} = \beta_{\text{EQUITY}} = \left\{ \frac{1}{1 + \left[(1-t) \frac{D}{E} \right]} \right\}$$

project beta:

$$\beta_{\text{PROJECT}} = \beta_{\text{ASSET}} = \left\{ 1 + \left[(1-t) \frac{D}{E} \right] \right\}$$

cost of common equity with a country risk premium:

$$k_{ce} = R_f + \beta [E(R_{\text{MKT}}) - R_f + \text{country risk premium}]$$

$$\text{break point} = \frac{\text{amount of capital at which the component's cost of capital changes}}{\text{weight of the component in the capital structure}}$$

$$\text{degree of operating leverage} = \frac{Q(P-V)}{Q(P-V)-F} = \frac{\% \Delta \text{EBIT}}{\% \Delta \text{sales}}$$

$$\text{degree of financial leverage} = \frac{\text{EBIT}}{\text{EBIT}-I} = \frac{\% \Delta \text{EPS}}{\% \Delta \text{EBIT}}$$

$$\text{degree of total leverage} = \text{DOL} \times \text{DFL} = \frac{\% \Delta \text{EPS}}{\% \Delta \text{sales}}$$

$$\text{breakeven quantity of sales} = \frac{\text{fixed operating costs} + \text{fixed financing costs}}{\text{price} - \text{variable cost per unit}}$$

$$\text{operating breakeven quantity of sales} = \frac{\text{fixed operating costs}}{\text{price} - \text{variable cost per unit}}$$

$$\text{current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

$$\text{quick ratio} = \frac{\text{cash} + \text{short-term marketable securities} + \text{receivables}}{\text{current liabilities}}$$

$$\text{receivables turnover} = \frac{\text{credit sales}}{\text{average receivables}}$$

$$\text{number of days of receivables} = \frac{365}{\text{receivables turnover}} = \frac{\text{average receivables}}{\text{average day's credit sales}}$$

$$\text{inventory turnover} = \frac{\text{cost of goods sold}}{\text{average inventory}}$$

$$\text{number of days of inventory} = \frac{365}{\text{inventory turnover}} = \frac{\text{average inventory}}{\text{average day's COGS}}$$

$$\text{payables turnover ratio} = \frac{\text{purchases}}{\text{average trade payables}}$$

$$\text{number of days of payables} = \frac{365}{\text{payables turnover ratio}} = \frac{\text{average payables}}{\text{average day's purchases}}$$

$$\text{operating cycle} = \text{average days of inventory} + \text{average days of receivables}$$

$$\text{cash conversion cycle} = \left(\frac{\text{average days}}{\text{of receivables}} \right) + \left(\frac{\text{average days}}{\text{of inventory}} \right) - \left(\frac{\text{average days}}{\text{of payables}} \right)$$

$$\% \text{ discount} = \left(\frac{\text{face value} - \text{price}}{\text{face value}} \right)$$

$$\text{discount-basis yield} = \left(\frac{\text{face value} - \text{price}}{\text{face value}} \right) \left(\frac{360}{\text{days}} \right) = \% \text{ discount} \times \left(\frac{360}{\text{days}} \right)$$

$$\text{money market yield} = \left(\frac{\text{face value} - \text{price}}{\text{price}} \right) \left(\frac{360}{\text{days}} \right) = \text{holding period yield} \times \left(\frac{360}{\text{days}} \right)$$

$$\text{bond equivalent yield} = \left(\frac{\text{face value} - \text{price}}{\text{price}} \right) \left(\frac{365}{\text{days to maturity}} \right)$$

$$= \text{holding period yield} \times \left(\frac{365}{\text{days}} \right)$$

$$\text{cost of trade credit} = \left(1 + \frac{\% \text{ discount}}{1 - \% \text{ discount}} \right)^{\frac{365}{\text{days past discount}}} - 1$$

where:

days past discount = number of days after the end of the discount period

$$\text{margin call price} = P_0 \left(\frac{1 - \text{initial margin}}{1 - \text{maintenance margin}} \right)$$

$$\text{price-weighted index} = \frac{\text{sum of stock prices}}{\text{number of stocks in index adjusted for splits}}$$

$$\text{market cap-weighted index} = \frac{\sum [(\text{price}_{\text{today}})(\text{number of shares outstanding})]}{\sum [(\text{price}_{\text{base year}})(\text{number of shares outstanding})]} \times \text{base year index}$$

$$\text{preferred stock valuation model: } P_0 = \frac{D_p}{k_p}$$

$$\text{one-period stock valuation model: } P_0 = \frac{D_1}{1 + k_e} + \frac{P_1}{1 + k_e}$$

infinite period model: $P_0 = \frac{D_1}{k_e - g} = \frac{D_0 \times (1+g)}{k_e - g}$

multistage model:

$$P_0 = \frac{D_1}{(1+k_e)} + \frac{D_2}{(1+k_e)^2} + \dots + \frac{D_n}{(1+k_e)^n} + \frac{P_n}{(1+k_e)^n}$$

where :

$P_n = \frac{D_{n+1}}{k_e - g_c}$, and D_{n+1} is a dividend that will grow at the constant rate of g_c forever

earnings multiplier: $\frac{P_0}{E_1} = \frac{\frac{D_1}{E_1}}{k - g}$

expected growth rate: $g = (\text{retention rate})(\text{ROE})$

trailing P/E = $\frac{\text{market price per share}}{\text{EPS over previous 12 months}}$

leading P/E = $\frac{\text{market price per share}}{\text{forecast EPS over next 12 months}}$

P/B ratio = $\frac{\text{market value of equity}}{\text{book value of equity}} = \frac{\text{market price per share}}{\text{book value per share}}$

where:

book value of equity = common shareholders' equity
= (total assets–total liabilities)–preferred stock

P/S ratio = $\frac{\text{market value of equity}}{\text{total sales}} = \frac{\text{market price per share}}{\text{sales per share}}$

P/CF ratio = $\frac{\text{market value of equity}}{\text{cash flow}} = \frac{\text{market price per share}}{\text{cash flow per share}}$

enterprise value = market value of common and preferred stock
+ market value of debt
– cash and short-term investments

for an annual-coupon bond with N years to maturity:

$$\text{price} = \frac{\text{coupon}}{(1+\text{YTM})} + \frac{\text{coupon}}{(1+\text{YTM})^2} + \dots + \frac{\text{coupon} + \text{principal}}{(1+\text{YTM})^N}$$

for a semiannual-coupon bond with N years to maturity:

$$\text{price} = \frac{\text{coupon}}{\left(1 + \frac{\text{YTM}}{2}\right)} + \frac{\text{coupon}}{\left(1 + \frac{\text{YTM}}{2}\right)^2} + \dots + \frac{\text{coupon} + \text{principal}}{\left(1 + \frac{\text{YTM}}{2}\right)^{N \times 2}}$$

bond value using spot rates:

$$\text{no-arbitrage price} = \frac{\text{coupon}}{(1+S_1)} + \frac{\text{coupon}}{(1+S_2)^2} + \dots + \frac{\text{coupon} + \text{principal}}{(1+S_N)^N}$$

full price between coupon payment dates:

(Bond value at last coupon date based on the current YTM) $\times (1 + \text{YTM}/\#)^{t/T}$

where # is the number of coupon periods per year, t is the number of days from the last coupon payment date until the date the bond trade will settle, and T is the number of days in the coupon period.

flat price = full price – accrued interest

current yield = $\frac{\text{annual cash coupon payment}}{\text{bond price}}$

forward and spot rates: $(1 + S_2)^2 = (1 + S_1)(1 + 1y1y)$

option-adjusted spread: OAS = Z-spread – option value

modified duration = $\frac{\text{Macaulay duration}}{1 + \text{YTM}}$

approximate modified duration = $\frac{V_- - V_+}{2V_0 \Delta \text{YTM}}$

effective duration = $\frac{V_- - V_+}{2V_0 \Delta \text{curve}}$

money duration = annual modified duration \times full price of bond position

money duration per 100 units of par value =

annual modified duration \times full bond price per 100 of par value

price value of a basis point: PVBP = $[(V_- - V_+) / 2]$

approximate convexity = $\frac{V_- + V_+ - 2V_0}{(\Delta \text{YTM})^2 V_0}$

approximate effective convexity = $\frac{V_- + V_+ - 2V_0}{(\Delta \text{curve})^2 V_0}$

% Δ full bond price

= $-\text{annual modified duration}(\Delta \text{YTM}) + \frac{1}{2} \text{annual convexity}(\Delta \text{YTM})^2$

duration gap = Macaulay duration – investment horizon

return impact $\approx -\text{duration} \times \Delta \text{spread} + \frac{1}{2} \text{convexity} \times (\Delta \text{spread})^2$

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SCHWESERNOTES™ 2020 LEVEL I CFA® BOOK 4: CORPORATE FINANCE, EQUITY INVESTMENTS, AND FIXED INCOME

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Published in 2019 by Kaplan, Inc.

Printed in the United States of America.

ISBN: 978-1-4754-9513-3

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